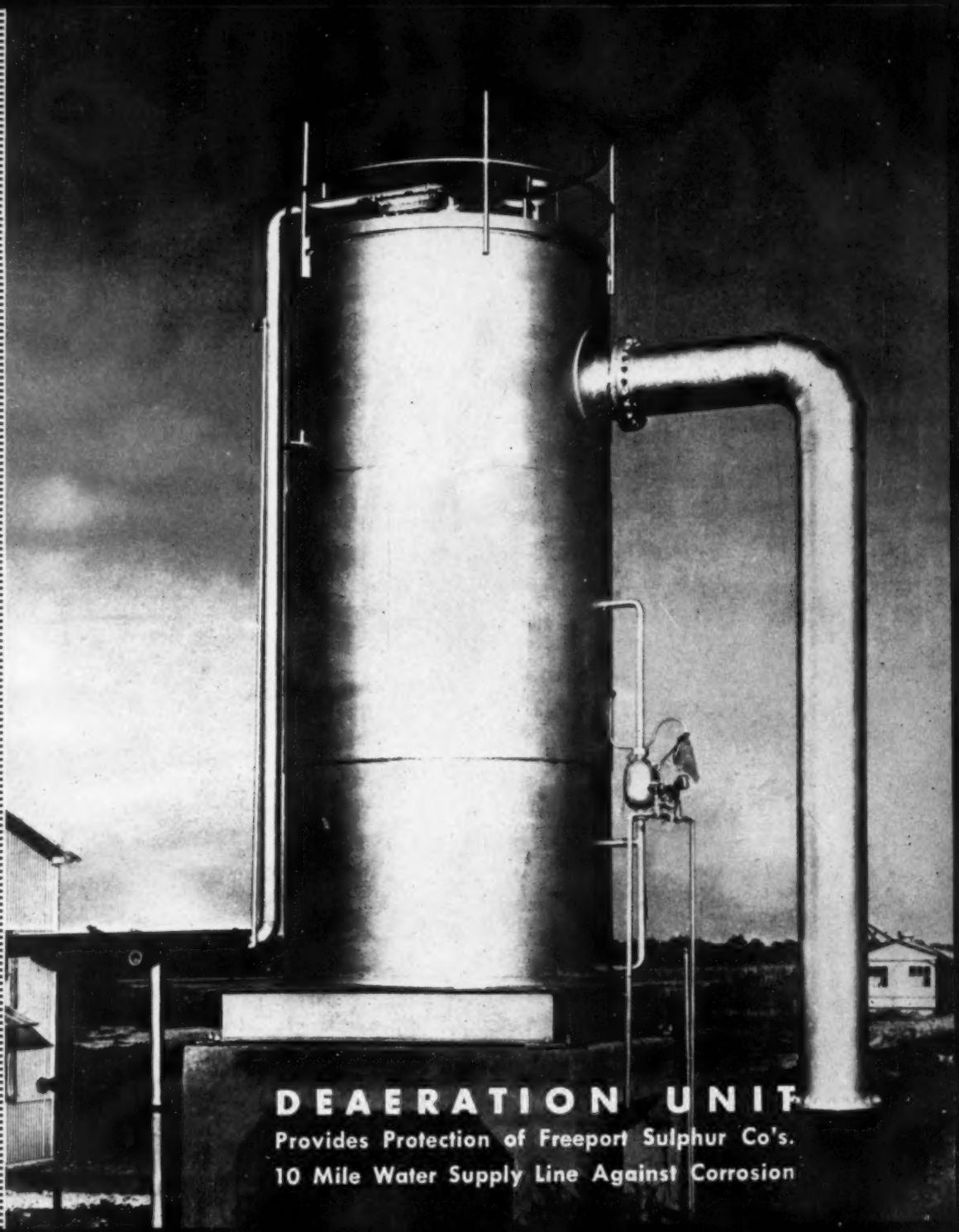
WATER & SEWAGE WORKS

MARCH
1946

A GILLETTE

PUBLICATION

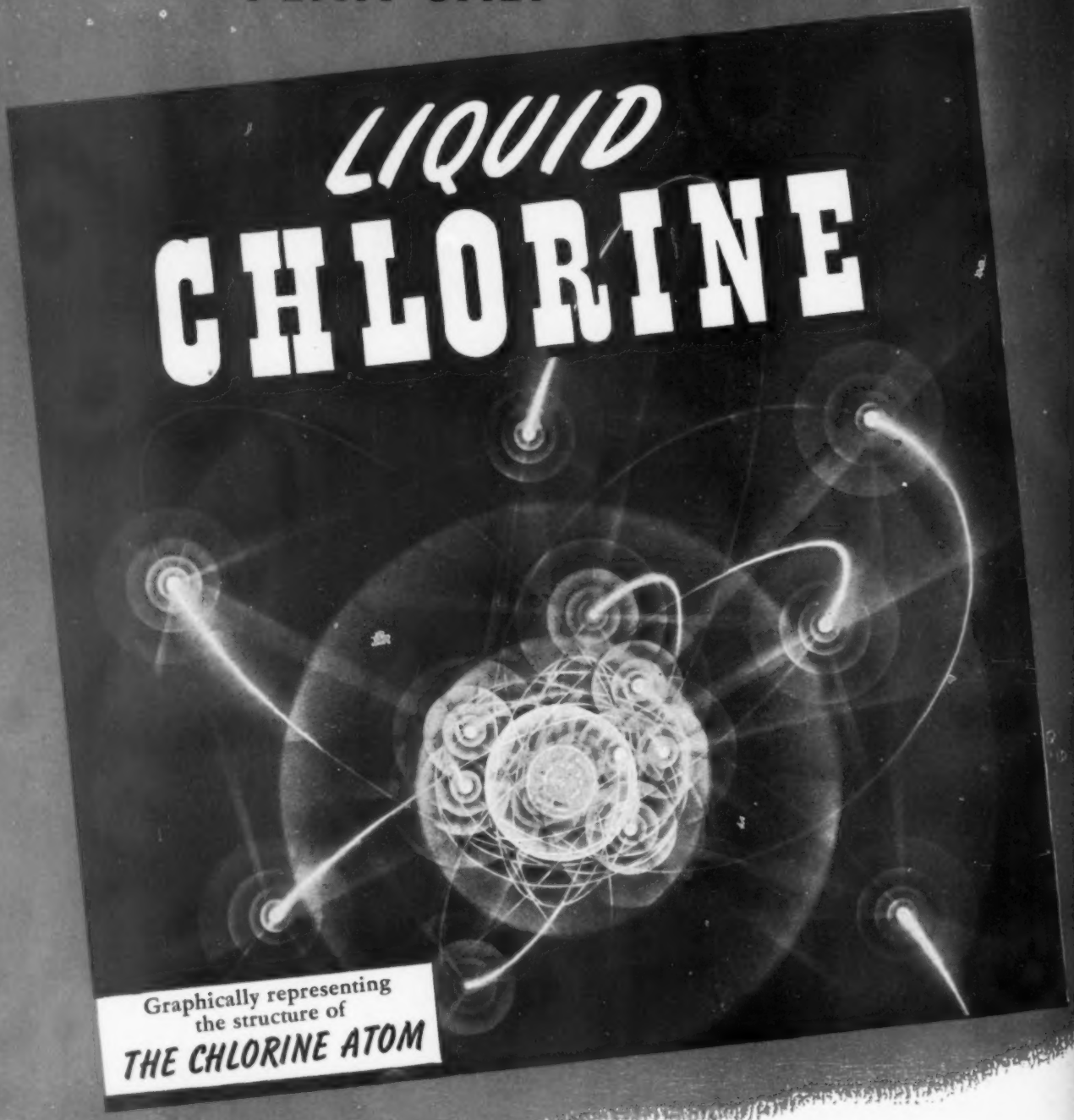


DEAERATION UNIT

Provides Protection of Freeport Sulphur Co's.
10 Mile Water Supply Line Against Corrosion

PENN SALT

LIQUID CHLORINE



Graphically representing the structure of
THE CHLORINE ATOM

PENN SALT LIQUID CHLORINE is valuable in water purification, swimming pool sanitation, sewage treatment, slime prevention and control. Write for full information.

OTHER PENN SALT PRODUCTS INCLUDE

Anhydrous Ammonia
Filter Alum
Ferric Chloride
Sodium Aluminate
Chloride of Lime
Caustic Soda
Perchloron

PENNSYLVANIA SALT MANUFACTURING COMPANY
Chemicals

1000 WIDENER BUILDING, PHILADELPHIA 7, PA.

NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • CINCINNATI • MINNEAPOLIS • WYANDOTTE • TACOMA

WATER AND SEWAGE WORKS, March, 1946. Volume 93, Number 3. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, March 12, 1946, at the Post Office at Chicago, Ill., under act of March 3, 1879.

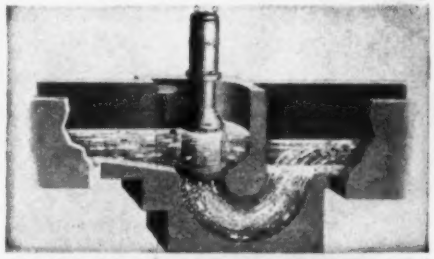
SOLVED

TOUGH SEWAGE PROBLEMS

. . . . through intensive engineering application

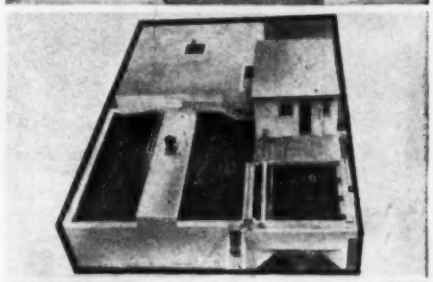
SCREENINGS HANDLING AND DISPOSAL

Comminutors eliminate screenings handling and disposal by burial or incineration, the worst nuisance in sewage plants. Sewage solids are automatically screened and cut under water in the inlet channel. Comminuted solids settle in the primary tank and are pumped to the digester. Over 1,200 installed since 1933. Ask for Bulletin 185.



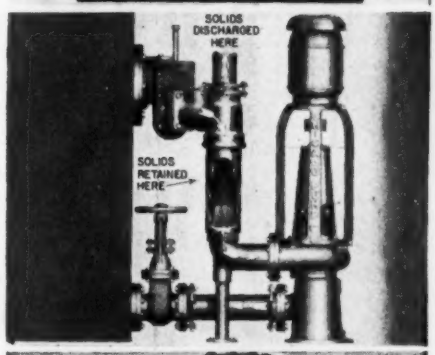
"PACKAGE" SEWAGE PLANTS

The problem of complete sewage treatment for small communities has been solved by Chicago "Package" Plants. They are low in cost, simple to operate, odorless, and produce a sparkling clear effluent. Over 100 installed since 1936. Ask for Bulletin 128-K1.



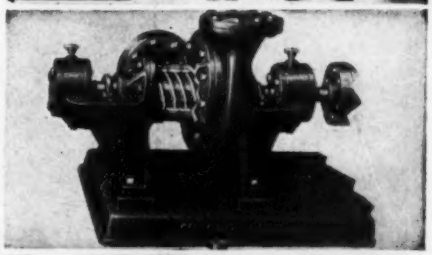
PUMP CLOGGING

"Flush-Kleens" eliminate pump clogging, because sewage solids do not pass through pump impellers. Over 3,000 installed since 1924. Ask for Bulletin 122.



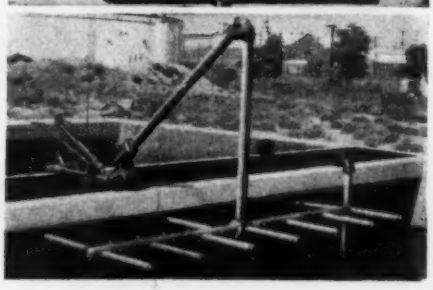
PRIMARY SLUDGE PUMPING

The Scru-Peller, a centrifugal pump with cutting screw feed. Pumps primary sludge as easy as clear water. Over 600 installed since 1934. Ask for Bulletin 190.



ACTIVATED SLUDGE CONTROL

Chicago Wide Band Air Diffusion System with Swing Diffusers provides positive control of the Activated Sludge Process for consistent complete sewage treatment. The diffuser tubes can be raised to the tank walk for respacing and easy maintenance without interrupting operation or draining the aeration tank. Over 100 installations since 1936. Ask for Bulletin 175.



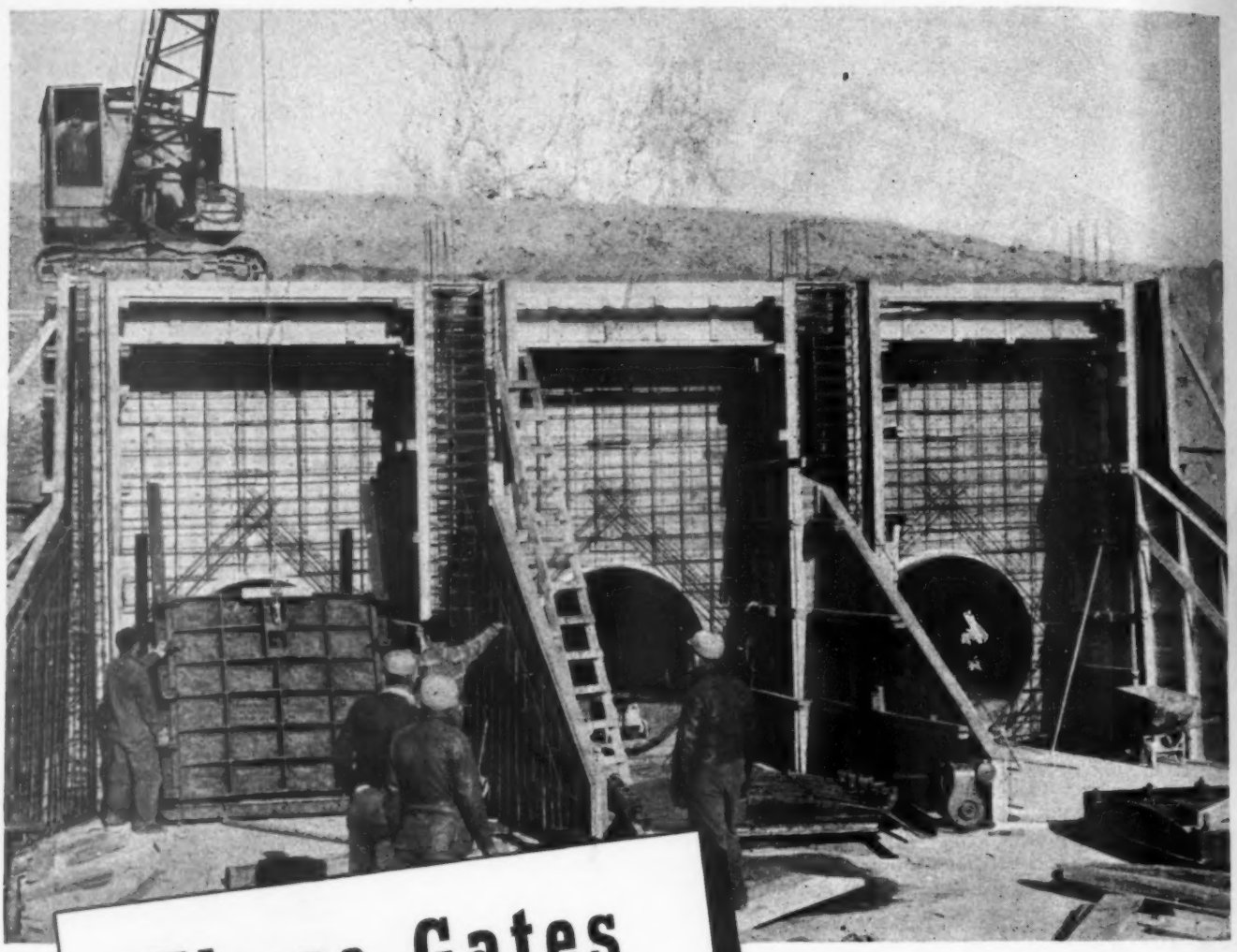
CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2349 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Flush-Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.



These Gates STOP Backwater

Installing three Model 30-05C Hardesty water control gates on a mid-Western levee. They were designed for a differential head of 25 feet. Each gate is attached to 250 feet of 72-inch ARMCO Paved Invert (bituminous-coated) Pipe with watertight couplings and nine corrugated diaphragms as shown in the lower photograph.

Levee openings for tributary streams and sewer outfalls need protection against high backwater from the main streams.

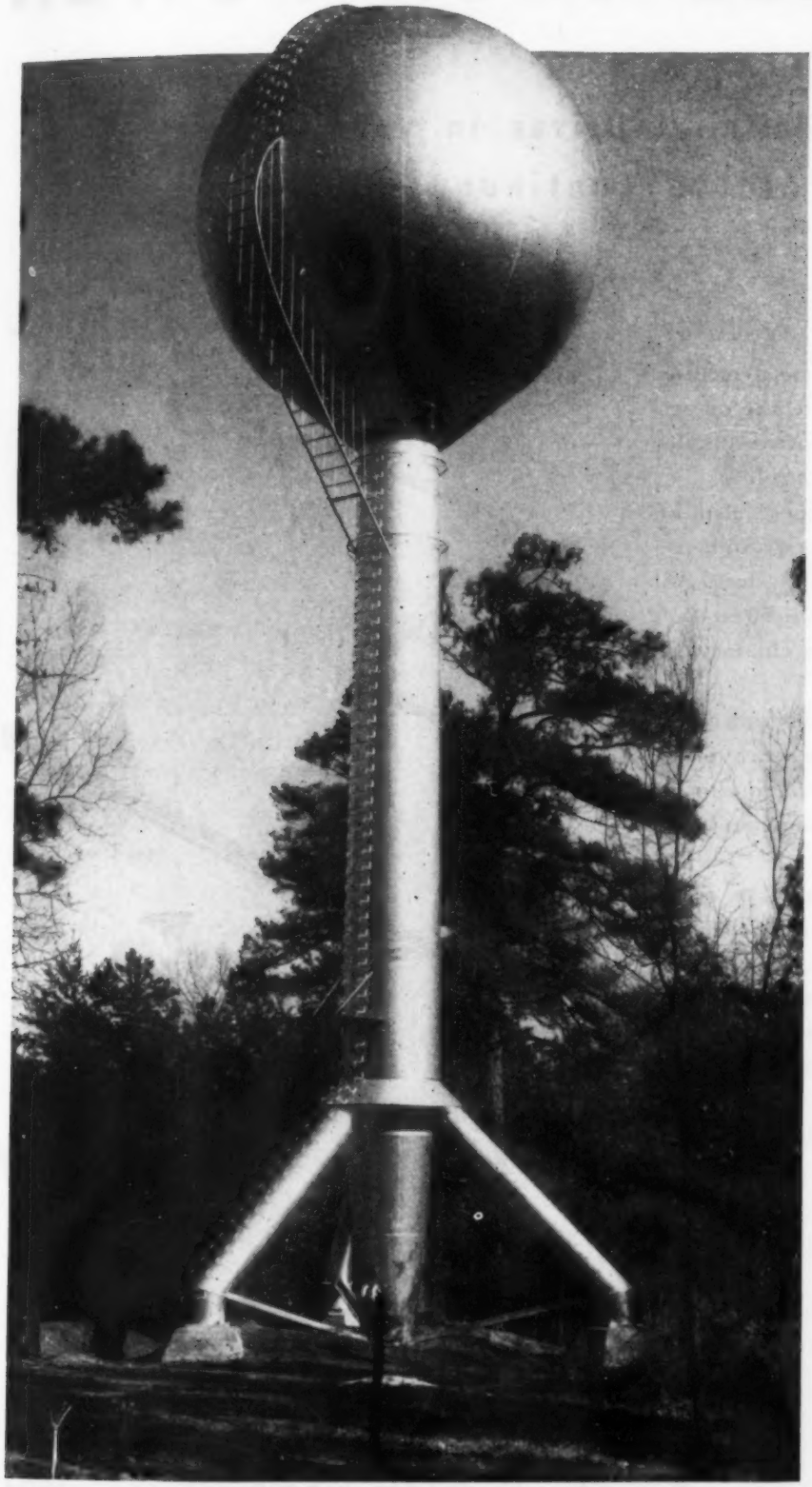
Calco-Hardesty Gates eliminate this hazard. They provide free outflow with quick, positive action to prevent backflow. These rugged gates are easily attached to ARMCO Corrugated Pipe or can be adapted to any type of drainage structure.

There are various types of Calco-Hardesty Gates—flap, slide and radial—from 8-inch diameter to 84 inches and larger. Write for free catalog. Armco Drainage & Metal Products, Inc., and Associated Companies, 65 Curtis Street, Middletown, Ohio.

ARMCO

CALCO-HARDESTY GATES

HERE'S A *Modern Slant* ON ELEVATED WATER STORAGE



It's the Watersphere . . . the modern answer to streamlined water storage. The 60,000-gal. Watersphere shown at the left supplements:

1. *A 60,000-gal. ellipsoidal-bottom tank 60 ft. to bottom.*
2. *A 200,000-gal. steel reservoir 35 ft. in diam. by 29½ ft.*
3. *Two 3,000,000-gal. steel reservoirs 120 ft. in diam. by 36½ft. and 131 ft. in diam. by 30½ ft.*

. . . in the water distribution system at Gadsden, Alabama.

IN addition to its attractive appearance, the Watersphere is highly functional in design. The single cylindrical column provides an economical means of support for the spherical tank. The plain surfaces are easier to maintain and require less material than tanks of conventional design with several columns.

The water supply system at Gadsden serves approximately 65,000 consumers. Water is taken from the Coosa River and is distributed through 24 miles of transmission mains ranging in size from 6 in. to 24 in. in diam. Average daily consumption is 5,619,000 gals.

Water works engineers are invited to write our nearest office for quotations on Waterspheres and other types of elevated tanks. Please state capacity and height to bottom.

CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th Street
Atlanta 3.....2181 Healey Bldg.
Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Drive
Philadelphia 3.....1644-1700 Walnut Street Bldg.
Washington 4.....703 Atlantic Bldg.
San Francisco 5.....1283-22 Battery St. Bldg.
Detroit 26.....1551 Lafayette Bldg.

Plants in Birmingham, Chicago and Greenville, Pa.

In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

NOW...ALL YOUR POWER

. . . For All Electrical Drives in your Sewage Plant as an Aid to Continuous Operation

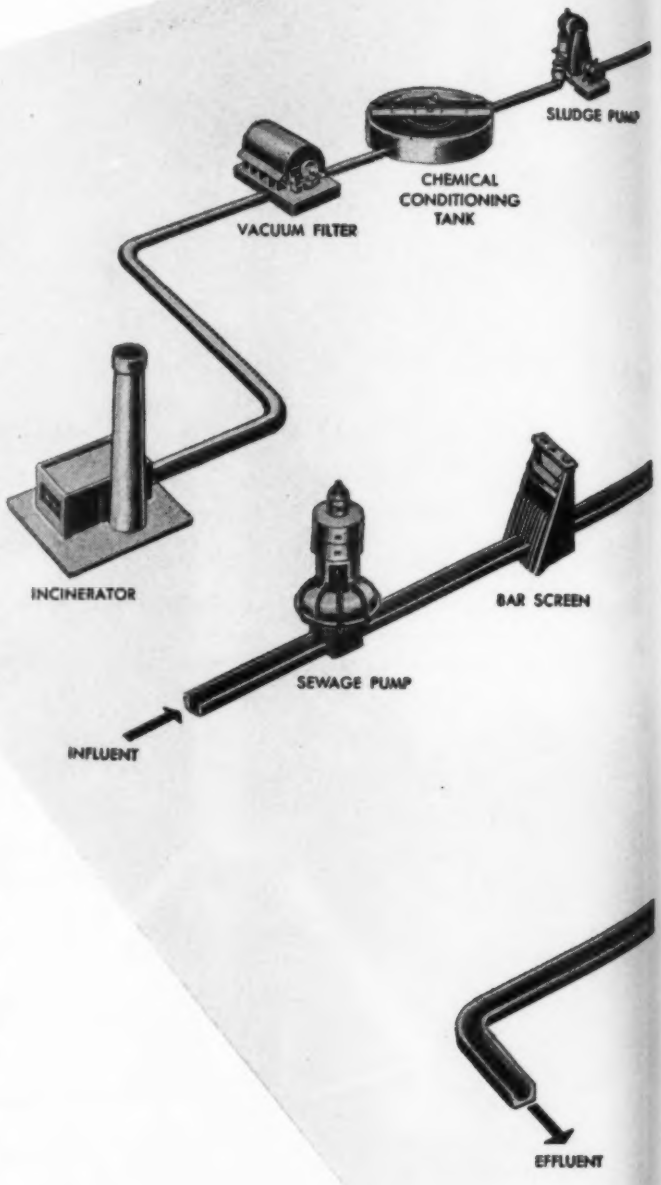
For the first time, Westinghouse metal-enclosed assembly of all power and control centers in one co-ordinated unit, makes possible an attractive installation and a new efficiency in power control.

Six standard, time tested Westinghouse elements comprise the assembly: incoming primary voltage—ASL air-cooled transformer—2300 v. feeders—ASL step-down transformer—low-voltage switchgear—and control center. Air-cooled transformers eliminate fire hazard and increase safety.

Any one control is but a step from any other—and constantly in plain view and within reach of the operator. The speed with which control adjustments can be made contributes greatly to continuous operation—the safeguard of Public Health.

Sections are individually metal-housed to reduce accident hazard and protect operating mechanisms. Installation is simple: no special foundations or transformer vaults are required. High accessibility of all controls reduces both inspection time and maintenance.

Being all-Westinghouse, the responsibility is all-Westinghouse. The 34 Westinghouse Manufacturing and Repair Shops throughout the country become your electrical maintenance department. From power transformers to pushbuttons, Westinghouse today is helping many cities in their "Blueprint Now" plans. Make Westinghouse your electrical partner at the planning board. Call your Westinghouse office, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-94715



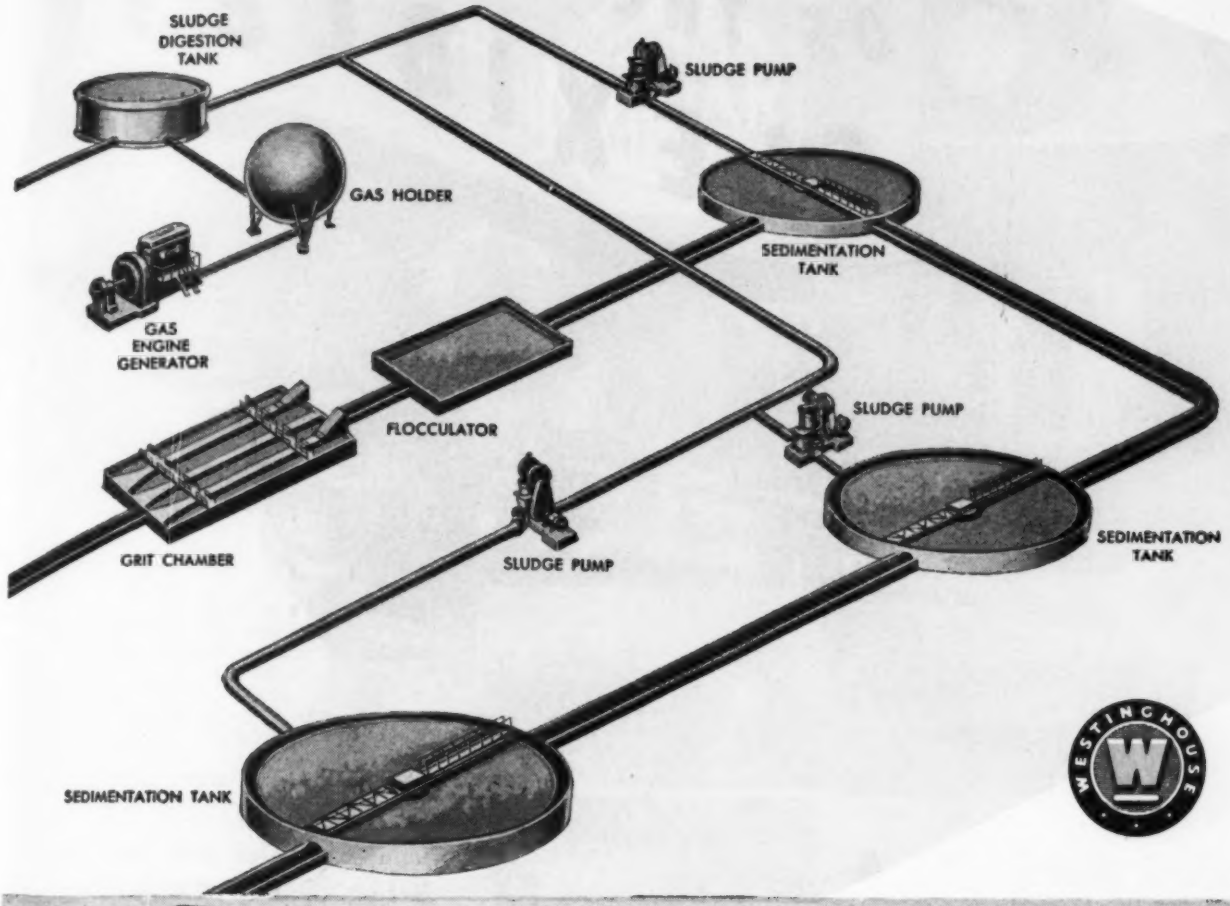
Westinghouse

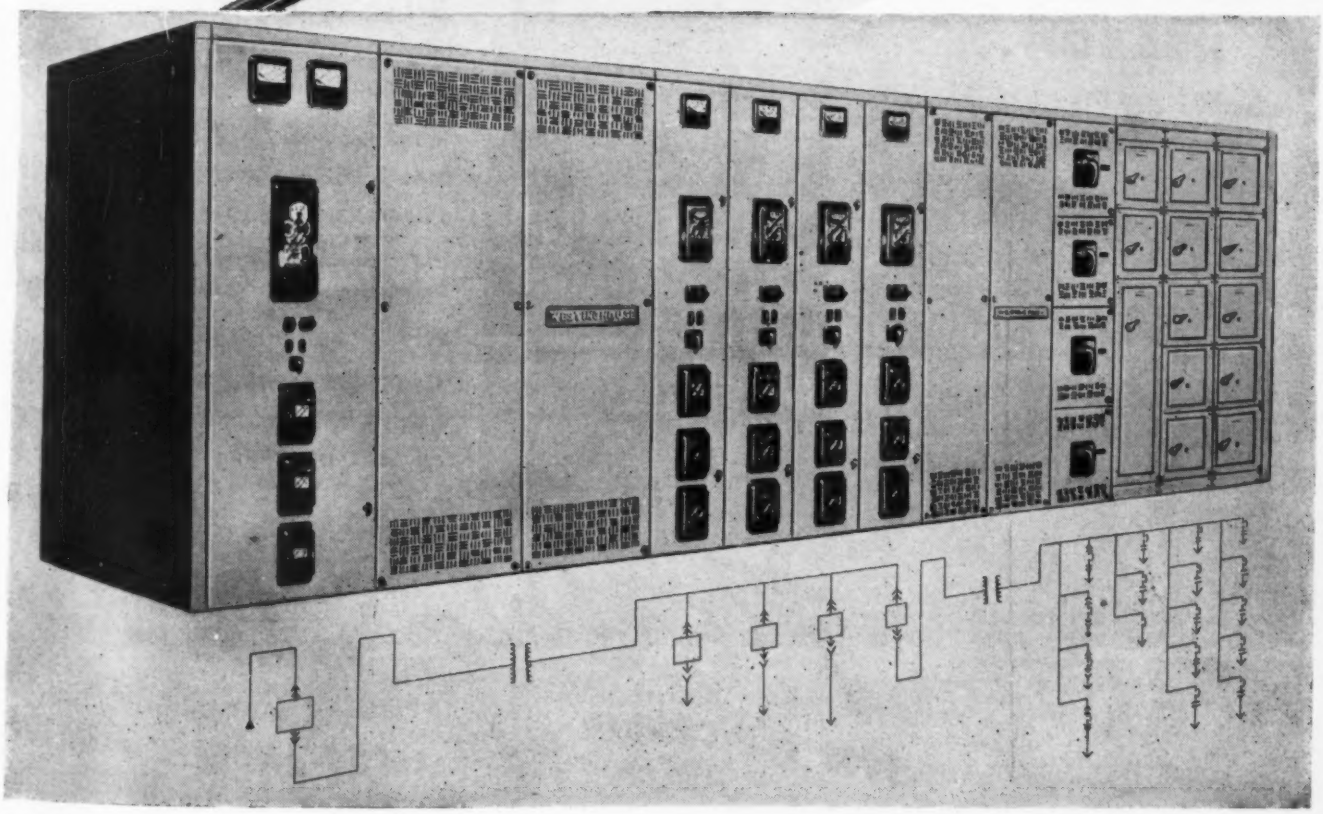
PLANTS IN 25 CITIES OFFICES EVERYWHERE

COMPLETE ELECTRICAL EQUIPMENT FOR SEWAGE WORKS

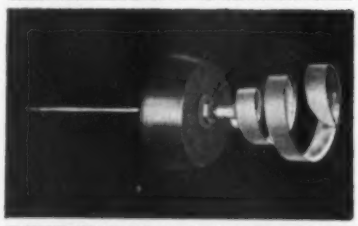
From power transformers to pushbuttons... Westinghouse

CONTROLS IN ONE PLACE





78% OF THE CITIES USE FLEXIBLES



THERE MUST BE A REASON...

ANSWER: Flexible methods eliminate the time-consuming, unsanitary part of the work. Actually a few men equipped with Flexibles can clean more pipe than an entire crew using old outmoded methods.

Flexible tools and methods eliminate more than 50% of the dig-ups that were once thought necessary. Dig-ups are expensive and troublesome — a dig-up prevented saves the labor of digging, the cost of back filling and patching the street, and the trouble of detouring traffic.

Handle all kinds of jobs with Flexibles. There is a complete line of tools and attachments for every pipe cleaning job from removing sand and rocks to extracting roots and marine growths.

Write for an illustrated catalog and learn why Flexible methods are more efficient, more effective and fast.

615 Pickwick Bldg.
Kansas City 6, Mo.

1624 Harmon Place
Minneapolis 3,
Minn.

P.O. Box 165
Atlanta

P.O. Box 694
Gulfport, Miss.

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1208 W. Chase Ave.
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Pittsburgh

401 Broadway
New York 13

29 Cerdan Ave.
Roslindale 31,
Mass.

Flexible SEWER ROD EQUIPMENT CO.

9059 VENICE BOULEVARD • LOS ANGELES • CALIF.

If You're Stuck with a Water Problem

USE NUCHAR — INSURES PALATABLE DRINKING WATER

Water consumers demand water that is free of taste and odor, and problems of water works officials are many in trying to deliver water that is palatable the year 'round. Aqua Nuchar Activated Carbon is the answer to many water problems because it works on the principle of adsorption . . . removing impurities surely and economically.

Yes, Aqua Nuchar is doing a big job . . . delivering water that is free from objectionable tastes and odors in hundreds of cities throughout the country.

If you're stuck with a water problem you can depend on Aqua Nuchar Activated Carbon to assist you in delivering palatable water at an astoundingly low cost averaging less than two cents per capita per year.

Since you never can tell when purification problems will arise, the makers of Aqua Nuchar Activated Carbon have spotted warehouse stocks at strategic points throughout the country. Yes, Aqua Nuchar is as near as your telephone. Its extreme adsorptive power is ready to go to work for you on short notice.

MEET ME IN ST. LOUIS

May 6-10, 1946, A.W.W.A. CONVENTION
. . . make train reservations now!

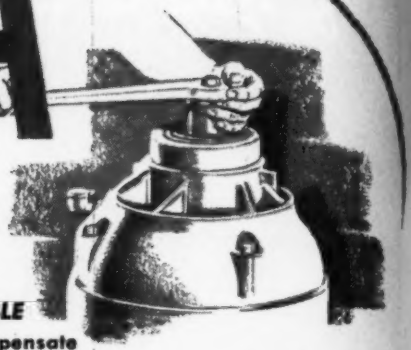
NUCHAR — INSURES PALATABLE DRINKING WATER

INDUSTRIAL CHEMICAL SALES

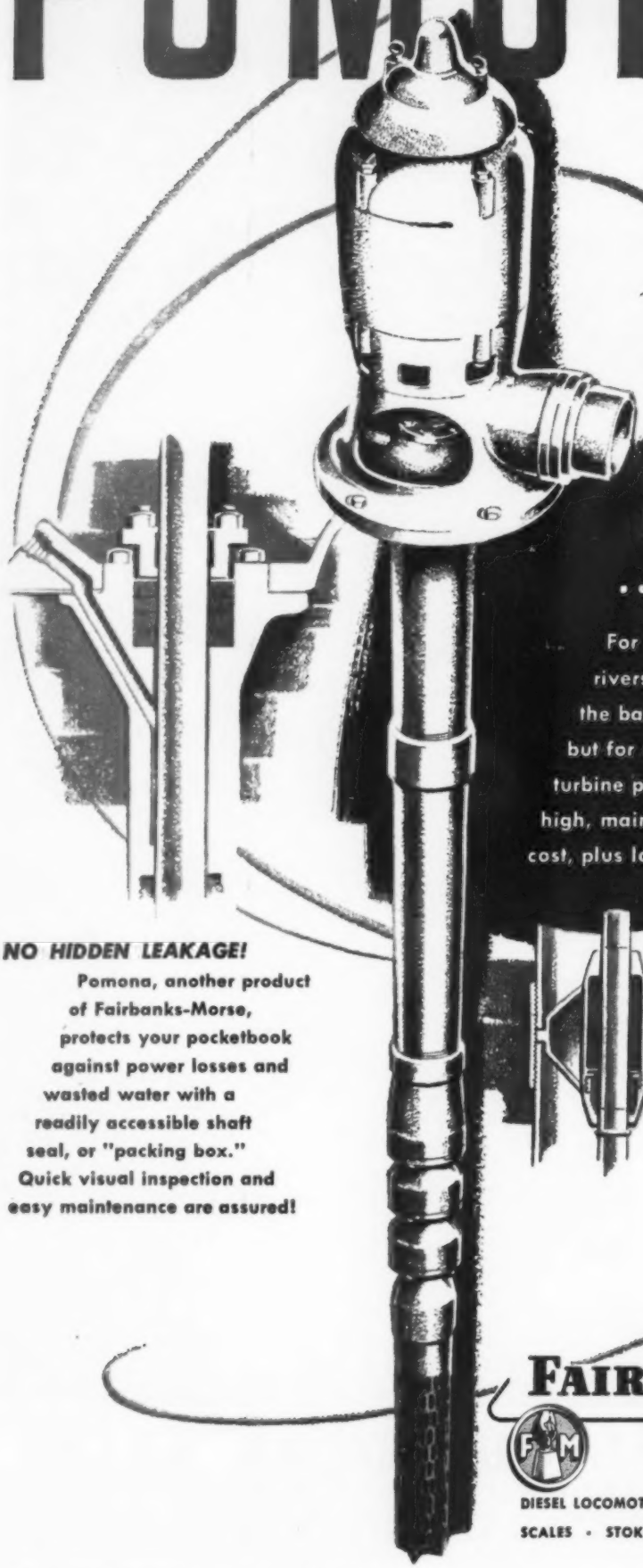
DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

230 PARK AVENUE, NEW YORK 17, N.Y. — 35 E. WACKER DRIVE, CHICAGO 1, ILLINOIS — 748 PUBLIC LEDGER BLDG., PHILADELPHIA 6, PA. — 844 LEADER BLDG., CLEVELAND 14, OHIO

POMONA



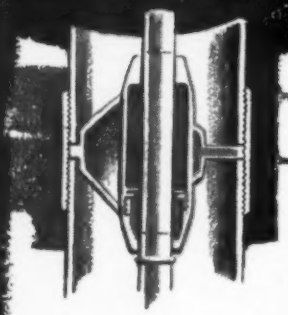
ADJUSTABLE You can compensate your Pomona pump for wear—restore proper running clearance when at last it's necessary—by one simple "topside" adjustment. No need to pull the pump to eliminate recirculation; no high adjustment costs—and valuable pumping time is saved!



Where there's a well ...here's the way!

For pumping water from wells, pits, sumps, lakes, rivers, etc., here's the way to cut costs per gallon to the barest minimum—not only in the first year, but for many, many years to come! Pomona vertical turbine pumps have the combination you're after—high, maintained efficiency for continued low power cost, plus lowest yearly maintenance expense!

NO HIDDEN LEAKAGE! Pomona, another product of Fairbanks-Morse, protects your pocketbook against power losses and wasted water with a readily accessible shaft seal, or "packing box." Quick visual inspection and easy maintenance are assured!



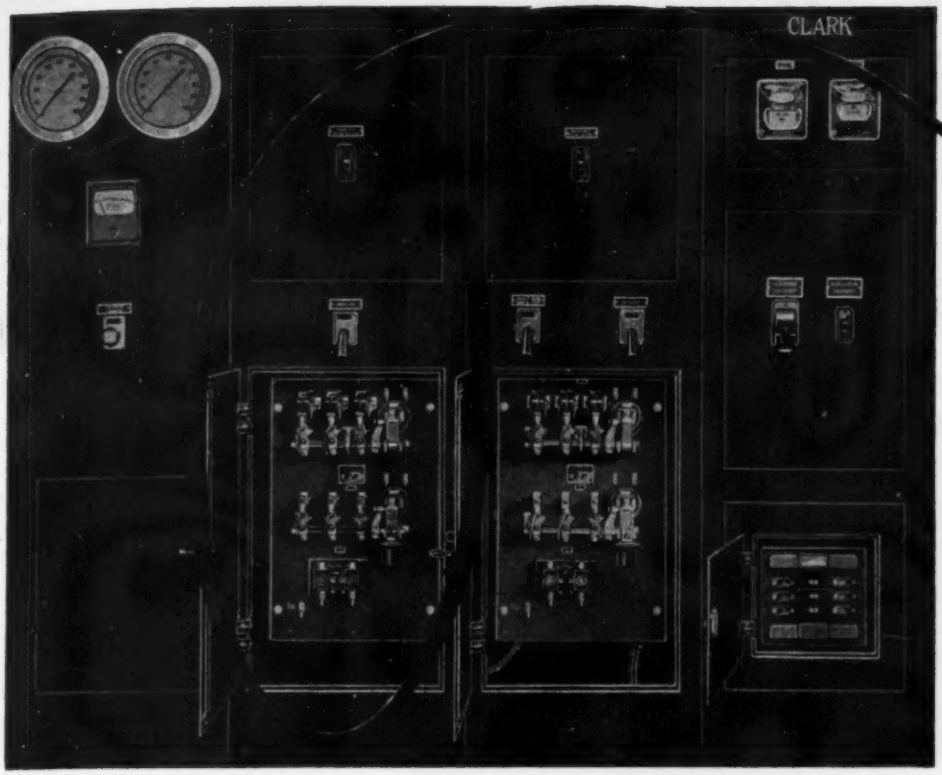
WHAT DO YOU NEED? The patented Pomona revolvable, water-lubricated rubber bearing with double (inside and out) bearing surfaces means quiet vibration-free shaft support under all conditions. Fairbanks-Morse vertical turbine pumps are built in sizes from 4" to 36"—with oil or water-lubrication—semi-open or enclosed impellers. Call your nearest Fairbanks-Morse office or your Pomona dealer for information on the pump best fitted to your job.

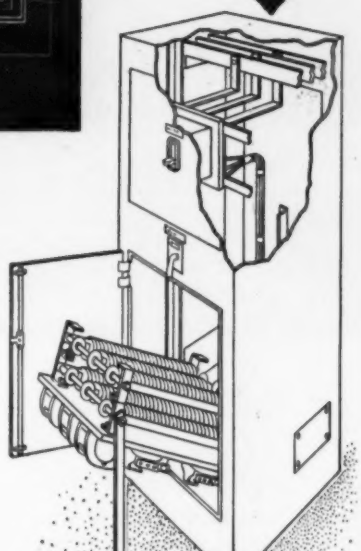
FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • MAGNETOS • GENERATORS • MOTORS • PUMPS
SCALES • STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT

3C presents STANDARD CUBICLE CONTROL CENTERS FOR SEWAGE DISPOSAL AND WATER TREATMENT PLANTS





Threedimensional cutaway view of Motor Control Cubicle, showing sturdy switch-gear type construction, arrangement for continuous bus, and swing-out feature of reduced voltage starting panels.

Here is a definite step forward in the design of cubicle control equipment for sewage disposal and water treatment plants. The three basic panel forms—Incoming Line, Motor Control and Gauge Cubicles—are made to match in overall height, depth, general construction and appearance. Other features include—

- Unit construction—Dead front steel panels.
- Flood space, 12" minimum.
- Physical arrangement flexible to suit any installation requirements.
- All maintenance possible from front.
- Continuous bus and pilot circuit wiring arrangements.
- Overload and short circuit protection for each motor.
- Swing-out construction on reduced voltage equipment (see sketch).
- Primary resistance type reduced voltage starting with non-breakable "3C" resistors.
- Station lighting from separate line or through transformer from Power Line.
- Power Company metering equipment can be accommodated on In-Coming Line Cubicle.
- Space provision for group mounting of flow meters, station clocks, recording and indicating gauges.

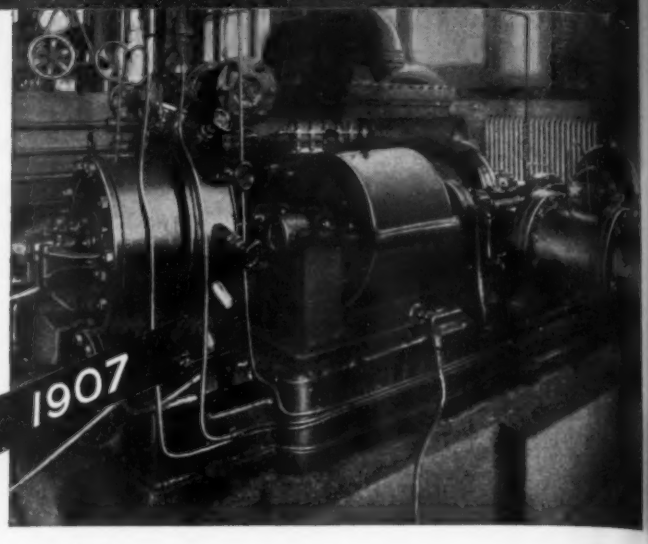
Write for "3C" Bulletin 9900 giving complete description, specification forms, outline dimensions and instructions for selecting proper cubicles.

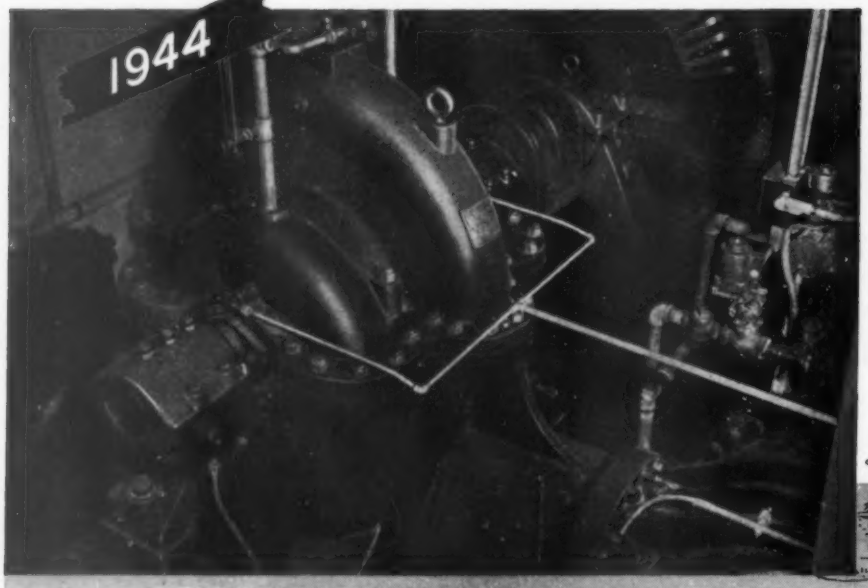
THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO • EVERYTHING UNDER CONTROL

Sustained Efficiency Year after Year Brings Repeat Orders Year after Year

DE LAVAL PUMPS at Philadelphia





1907 *De Laval turbine-driven pump installed at Torresdale Station, Philadelphia in 1907.*

1944 *De Laval 25 m.g.d., 245 feet head pump installed at Lardners Point Station, Philadelphia in 1943.*

Since the installation of the first De Laval centrifugal water works pump at Philadelphia in the year 1907, that city has purchased a total of 37 pumping units from De Laval, so satisfactory has been their performance. The repeated installation of De Laval pumps by that city has been due in no small measure to the high sustained efficiencies maintained over long periods of use by De Laval pumps—a fact substantiated by tests made on two units at the Shawmont Station, Philadelphia, where no measurable loss of efficiency was evident after six years of service.

4114

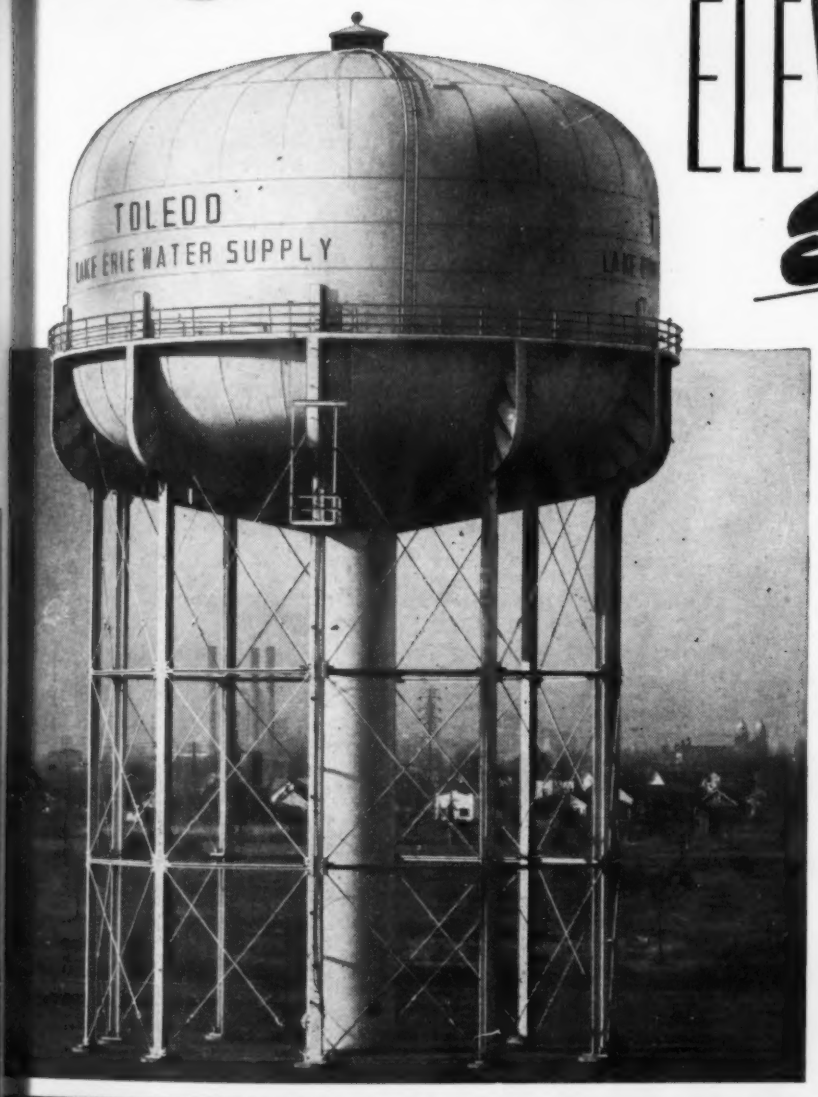
TURBINES • HELICAL GEARS WORM GEAR SPEED REDUCERS CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS and COMPRESSORS • IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

SALES OFFICES ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER DETROIT • HELENA • HONOLULU • HOUSTON KANSAS CITY • LOS ANGELES • MANILA MONTREAL • NEW HAVEN • NEW ORLEANS NEW YORK • PHILADELPHIA • PITTSBURGH ROCHESTER • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE • TORONTO • TULSA VANCOUVER • WASHINGTON, D.C. • WINNIPEG And Cities in Central and South America

PITTSBURGH • DES MOINES



ELEVATED STEEL TANKS

ASSURE IMPROVED WATER SERVICE FOR EVERY COMMUNITY NEED!

Fundamental to modern municipal progress is better water service for the consumer—expressed in the desirable forms of constant supply, uniform pressures around the clock, dependable fire protection, ample reserves for emergencies. Elevated water storage in Pittsburgh-Des Moines Steel Tanks provides these benefits at low cost—originally, and during their many years of useful life. Write for the complete story of Modern Water Storage in our illustrated new brochure: we'll send your copy promptly!

PITTSBURGH • DES MOINES STEEL CO.

PITTSBURGH, PA., 3412 NEVILLE ISLAND—DES MOINES, IOWA, 913 TUTTLE STREET
NEW YORK, ROOM 915, 270 BROADWAY · CHICAGO, 1216 FIRST NATIONAL BANK BUILDING
DALLAS, 1217 PRAETORIAN BUILDING · SAN FRANCISCO, 619 RIALTO BUILDING

PEERLESS PUMPS

UPON THE STRONG, GREATER STRENGTH IS BESTOWED

A Statement by FOOD MACHINERY CORPORATION in regard to *Dayton-Dowd*

An important advance in the history of the pumping industry now makes available a new conception of integrated pump service to customers.

Dayton-Dowd, long associated with sustained high quality—a distinguished name on centrifugal pumps—has become an integral part of the Peerless Pump organization.

To the prestige and enviable reputation of *Dayton-Dowd* have opened new horizons of progress and wider scope for service by alliance with the nation-wide facilities of *Food Machinery Corporation.*

Thus, to purchasers of both Horizontal and Vertical centrifugal pumps is available the coordinated engineering and research leadership that produced the FMC *"Water Buffalo"*— the first battle-proved amph-trac.

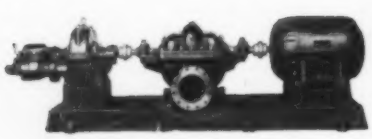
This merger of broad installation-wise experience, modern technical research and alert engineering talent assures our customers for all types of pumps that the name *Peerless* stands as the guarantee for quality and progress.

•

Peerless performance—all that the name implies.

PEERLESS HORIZONTAL PUMPS

—formerly Dayton-Dowd



Type A—Dual Drive

Type T—Turbine

Type A—Large Capacity

F.M.C. builds with STEEL

PEERLESS PUMP DIVISION—FOOD MACHINERY CORPORATION

Factories: Los Angeles, Calif. Quincy, Illinois. Canton, Ohio.

WAR-TIME BUILDERS OF THE VICTORIOUS "WATER BUFFALO" PEACE-TIME BUILDERS OF TOP-FLIGHT PUMPS.

Diamond

Modern quality-control methods are employed in the manufacture of Diamond Liquid Chlorine to assure production that meets your most exacting requirements. The high quality you need for water and sewage treatment is assured when you specify DIAMOND Liquid Chlorine.

Liquid

Diamond Liquid Chlorine can be shipped to you in the quantities most convenient for your use—in individual cylinders, in multi-unit cars or tank cars, as you wish. And whatever the quantity, you can always depend upon the high quality of Diamond Liquid Chlorine.

ALKALI

Chlorine

DIAMOND ALKALI COMPANY · Pittsburgh, Pa., and Everywhere

WHERE and HOW

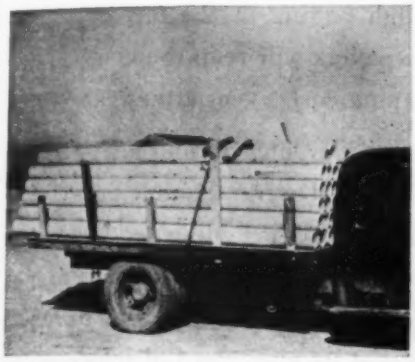
in installation, operation and

to REDUCE COSTS of maintenance of water lines

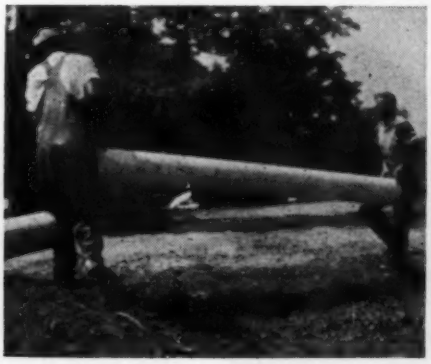
FROM its low initial installation cost to its far-reaching economies over the years . . . in both water transmission and distribution lines . . . TRANSITE PRESSURE PIPE can save you money.

Made of asbestos and cement, this modern pipe can't tuberculate . . . is highly resistant to soil corrosion. Easily handled and installed, it maintains high delivery capacity . . . forms tight yet flexible joints. It is used by thousands of communities all over the country because it provides more efficient, more economical water transportation year after year.

For complete information, write for brochure TR-11A. Johns-Manville, 22 East 40th Street, New York 16, N. Y.



TRUCKING COSTS hit bottom with Transite! Its light weight means more footage carried per truckload—time and money saved in transporting this pipe to the job.

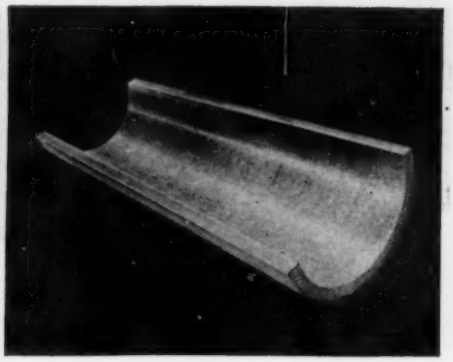


HANDLING COSTS too, are low. Fewer man-hours are required for unloading and lowering into the trench. Only the larger sizes require mechanical handling equipment.

EXCAVATING COSTS, as shown above, are low with Transite. Trenches are narrow and disturbance to pavement is kept to a minimum. No bell holes are required at the joints.

ASSEMBLY COSTS drop with Transite. The Simplex Coupling permits quick, easy assembly . . . assures joints that stay tight, even when the line is deflected as much as 5° at each coupling.

MAINTENANCE COSTS are cut with Transite. Its tight joints, high uniform strength, proven durability and corrosion-resistance all contribute to its economical performance.



OPERATING COSTS stay low because this asbestos-cement pipe cannot tuberculate. As a result, its delivery capacity (C-140) remains high; pumping costs are minimized.

Johns-Manville TRANSITE PIPE

A Two-Way Service to Taxpayers

. . . *and to You!*

When you install Gardner-Denver Centrifugals, you are sure of two things. First, that you will get the extra efficiency that comes from better design, smoother castings and thorough testing in the factory. Second, that taxpayers will reap the benefit in lower pumping costs, year after year.

Built extra rugged for long life and heavy duty service, Gardner-Denver Double Suction Centrifugal Pumps are designed for all heads up to 300 feet. Their capacity range is wide and they are adaptable to any type drive. Let us give you full information about these pumps—including the simplicity of installation. Write Gardner-Denver Company, Quincy, Illinois.

The horizontally split case construction assures ease of maintenance—the entire rotary assembly may be removed without disturbing piping connections.

GARDNER-DENVER

Since 1859

NO PIPE BENDS NEEDED HERE

Dresser Coupling FLEXIBILITY gives PLUS PROTECTION against the cost of detailed layouts . . . specials and expensive pipe bending in the field

Because Dresser Couplings permit deflections of from 2 to 6 degrees, and more, per joint (depending on diameter), you can avoid unforeseen obstacles such as heavy rock strata . . . small hills . . . unexpected underground structures in the limited space for ditching in busy city streets . . . without the expense and lost time of field engineering. You can make curves, deflections, or offsets *on the job* with Dresser Couplings . . . no expensive field pipe bending equipment or skilled labor needed.

In making these curves with straight pipe, all the advantages for which Dressers are famous are retained . . . protection of pipe against stresses due to temperature variations, earth settlement or misalignment . . . permanent tightness . . . simple installation . . . exact pipe alignment unnecessary before assembly . . . work in any weather, wet or dry ditch.

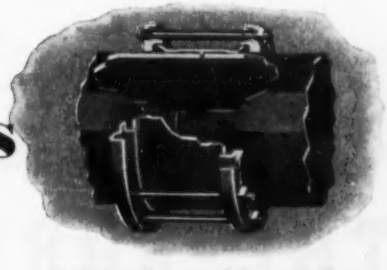
That's why Dressers are more than a coupling. They PROTECT the pipe, the joint and your investment in time and money.

Send us your inquiry on any pipe joining problem. It will receive prompt attention.

DRESSER MANUFACTURING DIVISION
373 Fisher Avenue, Bradford, Pa.
Houston Office and Warehouse,
1121 Rothwell Street, Sec. 16, Houston, Texas;
In Canada: Dresser Manufacturing Co., Ltd.,
60 Front Street, West, Toronto, Ontario.

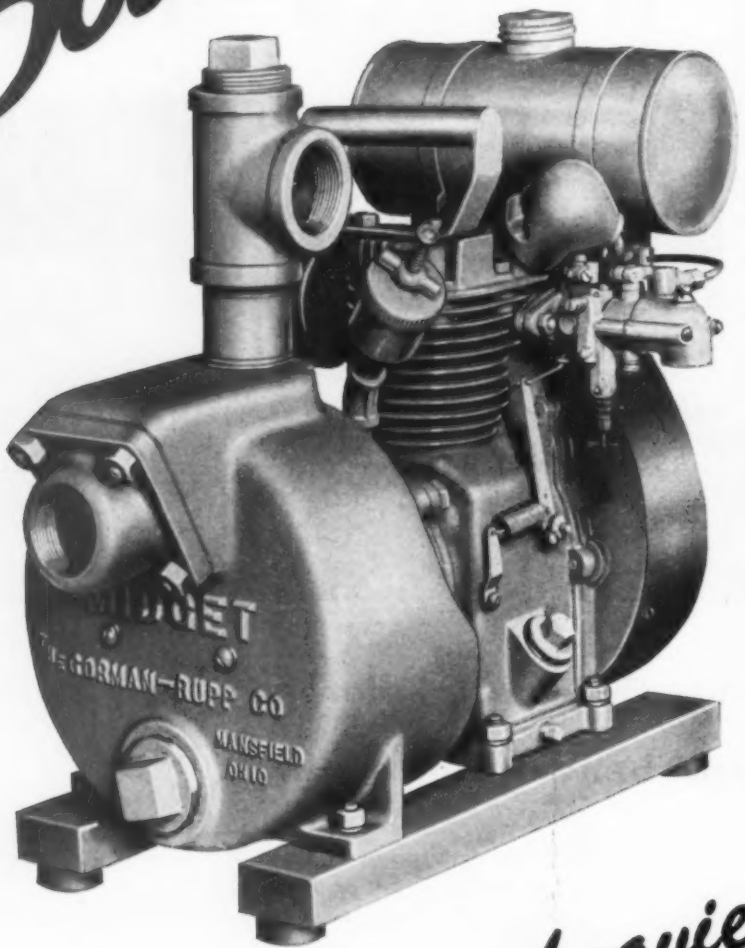
DRESSER COUPLINGS

ONE OF THE DRESSER INDUSTRIES



A Dresser is more than a coupling

3000 gallons per hour



and no bigger or heavier than a tool kit

WHAT DO YOU WANT IN A PUMP?

PORTABILITY?

– There's a Gorman-Rupp pump no bigger or heavier than a tool kit that will deliver 3,000 gallons per hour.

RUGGEDNESS?

– It's not uncommon for a Gorman-Rupp to run 60 days or more without interruption.

CAPACITY?

– You can get Gorman-Rupp pumps up to ratings of 125,000 gallons per hour.

RELIABILITY?

– You can't clog a Gorman-Rupp with any muck or solid that will pass the intake.

SIMPLICITY?

– All Gorman-Rupp pumps are full automatic self-priming. Start the motor and you start the water.

EFFICIENCY?

– By actual test it has been demonstrated that Gorman-Rupp pumps have not been equalled in pumping capacity for power or size. They are streamlined inside, where streamlining counts.

Ask what you want of a Gorman-Rupp pump – you will get more for your dollar, for a longer period of time.

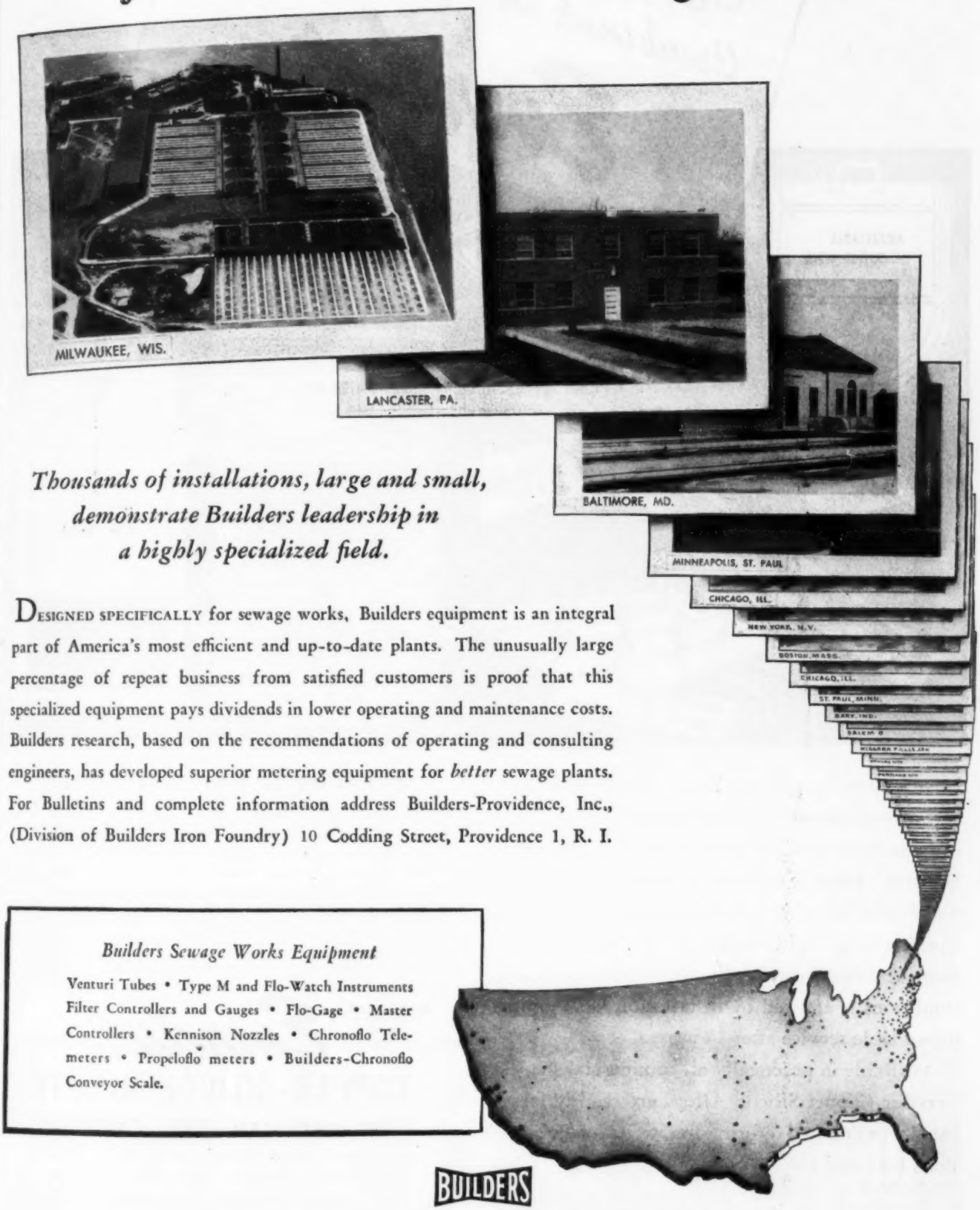
GORMAN-RUPP PUMPS
UNSURPASSED FOR PUMPING FAST
ARMY NAVY

THE GORMAN-RUPP COMPANY

MANSFIELD • OHIO

BUILDERS-PROVIDENCE

Builders of Metering Equipment for America's Finest Sewage Plants



Thousands of installations, large and small, demonstrate Builders leadership in a highly specialized field.

DESIGNED SPECIFICALLY for sewage works, Builders equipment is an integral part of America's most efficient and up-to-date plants. The unusually large percentage of repeat business from satisfied customers is proof that this specialized equipment pays dividends in lower operating and maintenance costs. Builders research, based on the recommendations of operating and consulting engineers, has developed superior metering equipment for *better* sewage plants. For Bulletins and complete information address Builders-Providence, Inc., (Division of Builders Iron Foundry) 10 Codding Street, Providence 1, R. I.

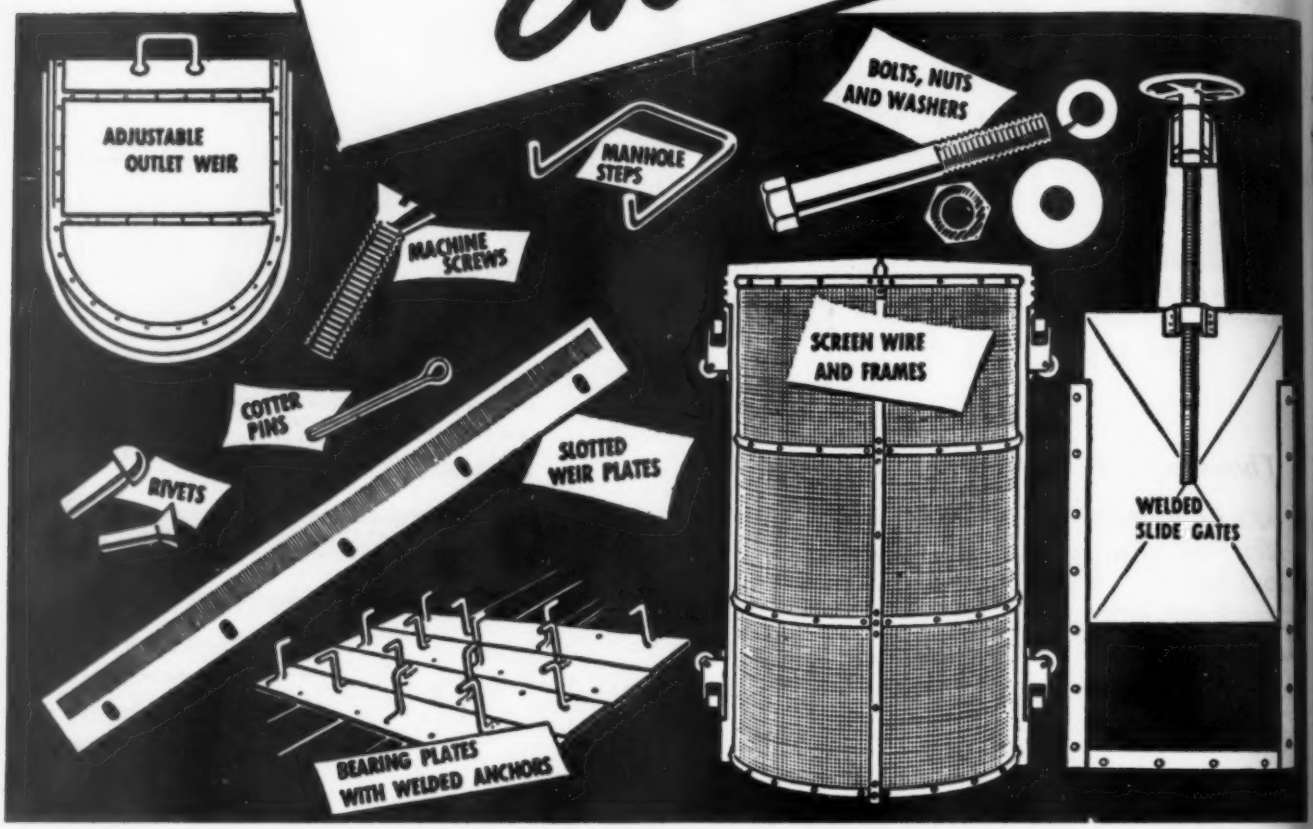
Builders Sewage Works Equipment

Venturi Tubes • Type M and Flo-Watch Instruments Filter Controllers and Gauges • Flo-Gage • Master Controllers • Kennison Nozzles • Chronoflo Telemeters • Propeloflo meters • Builders-Chronoflo Conveyor Scale.

BUILDERS

BUILDERS-PROVIDENCE

Light weight...Long life
Combined in equipment of
Everdur



HIGH STRENGTH, good welding characteristics and corrosion resistance equal to that of copper... this is the useful combination of properties offered by Everdur*. Because of these properties, Everdur is widely used for sewage treatment and waterworks equipment of light weight or welded construction. The durability of Everdur under corrosive conditions is attested by installations still giving dependable service after 18 years.

Available in practically all commercial shapes, Everdur Copper-Silicon Alloys are readily fabricated. For detailed information, write for Publications E-11 and E-6.

46211

*Reg. U. S. Pat. Off.

EVERDUR is widely used for:

Coarse and Fine Screens, Float Chambers, Swing Gates, Built-up Sluice Gates, Coarse Bar Rack Aprons, Effluent and Scum Weirs, Structural Scum Baffle Brackets, Troughs, Screen Hoppers, Orifices, Baskets, Pipe, Ladders, Float Gage Chains, Valve Springs, Guides, Walkways, Electrical Conduit, Flashboard Supports, Flush Box Fittings, Spillway Fittings, Valve Stems.

ANACONDA

Everdur

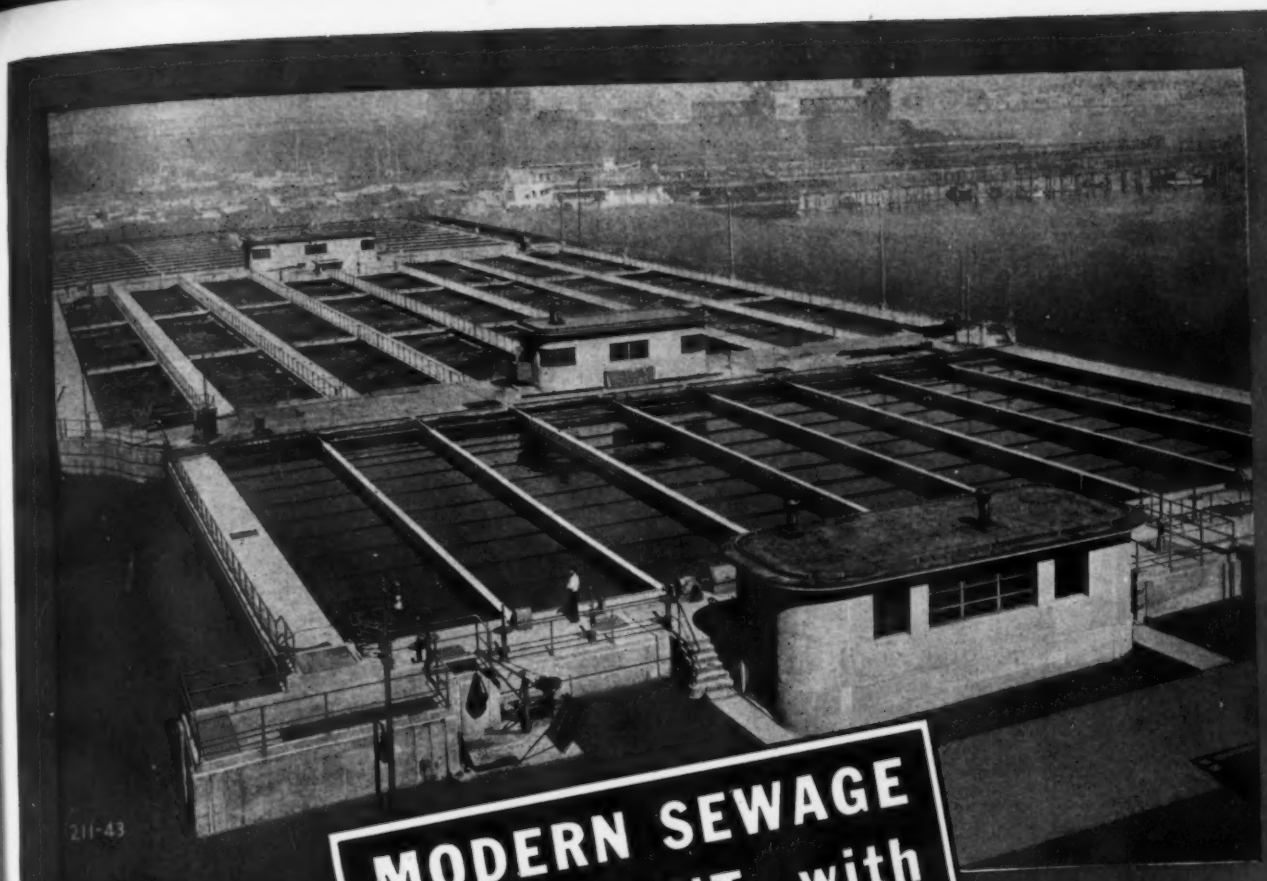
COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.



MODERN SEWAGE TREATMENT with *Jeffrey* EQUIPMENT

As the need grows for more adequate and modern sewage and water treatment, you will find Jeffrey equipment in more and more plants throughout the country.

Bar screens, screenings grinders, garbage grinders, grit collectors and washers, flocculators, sludge collectors for primary and secondary settling tanks . . . are just a few of the Jeffrey units (all patented) which make for efficient sewage and water purification and processing. Also equipment for biofiltration plants.

Jeffrey has the engineering staff—the manufacturing experience—and plant facilities to help you in designing and equipping your plant for most economical and efficient operation. Consult Jeffrey on sewage and water treatment equipment.

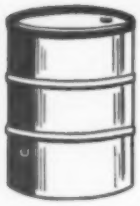
JEFFREY

ESTABLISHED 1877

CHEMICALS

VETERANS OF WORLD WAR II:
To help you in purchasing surplus property from War Assets Corporation, a veterans' unit has been established in each of our Regional Offices*.

GOVERNMENT-OWNED SURPLUS NOW!



HYPOCHLORITE BLEACH—one year old material; manufactured with 30% available chlorine; grade 3; available as follows for 1½ cents per pound in carload lots; (F.O.B. location).

Birmingham — 305,600 lbs. in 400 lb. drums. Also one carload of grade 2, packed in 100 lb. drums.

Salt Lake City—8,785,572 lbs. in 43 and 50 lb. steel drums.

40% CHLORINATED PARAFFIN for fire proof, water proof and mildew proof coatings. Approximately 9 million pounds available for 2 cents per pound in car load lots or total amount at a single location, F.O.B. location as follows:

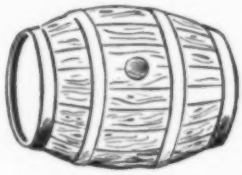
Boston, Cleveland, Detroit, Philadelphia, Richmond and Salt Lake City.

MIXED XYLIDINES; 7 cents per pound, carload lots, F.O.B. location.

POTASSIUM SULPHATE available for 10 cents per pound, F.O.B. location as follows:

Minneapolis: 93,075 lbs. in 400 lb. (app.) wooden barrels.

Chicago: 53,355 lbs. in 35 lb. fiber drums.



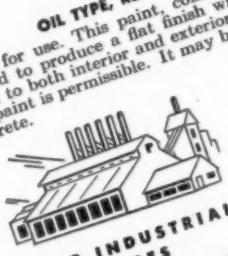
The chemicals shown here are surplus war material. They are available now at quick sale prices to meet civilian production needs. As with hundreds of other similar surplus chemicals they may be obtained by writing, wiring, or phoning your nearest War Assets Corporation office*. Make it *your* habit to check this source whenever your stock needs replenishing.

**In directories simply look up Reconstruction Finance Corporation. War Assets Corporation is an R.F.C. subsidiary.*

PAINTS

OIL TYPE, READY MIXED PAINT—SPEC. T-1215

Ready for use. This paint, containing linseed oil, may be brushed or sprayed to produce a flat finish which dries in a few hours. It is well suited to both interior and exterior walls wherever a medium grade low cost paint is permissible. It may be applied to wood, brick, masonry or concrete.



FOR INDUSTRIAL USES

Warehouses, Office Buildings, Shops & Garages, Housing, Fencing, Factories

COLORS

Light Green, Dark Green, Field Drab, Earth Yellow, Earth Brown, Sand, Olive Drab, Loam, Earth Red, Haze Gray, Black, White

For detailed information contact any of the War Assets Corporation Regional Offices below:

Price: 65 cents per gal., F.O.B. location; minimum sale, 200 gallons.

CHECK AND MAIL TODAY

To War Assets Corporation:

Without obligation, please send me further information on the following products and place my name on your regular mailing list:

- ☐ Glacial Acetic Acid, C.P. in one gal. bottles.
- ☐ Copper Napthenate, 8% solution in drums.
- ☐ Sodium Sulphite
- ☐ Manganous Chloride
- ☐ Smokeless Powder
- ☐ D.N.T. (Dinitrotoluol)
- ☐ Silica Gel; in various small size fabric bags weighing from 15 grams to 10 lbs. each.
- ☐ Khaki Dyes (basic colors)

Firm.....

Street.....

City.....State.....

155-2

A DISPOSAL AGENCY DESIGNATED BY THE SURPLUS PROPERTY ADMINISTRATION for Surplus Producers' and Capital Goods, Aircraft and Plants formerly handled by Reconstruction Finance Corporation . . . and for Surplus Consumer Goods formerly handled by United States Department of Commerce.

WAR ASSETS CORPORATION

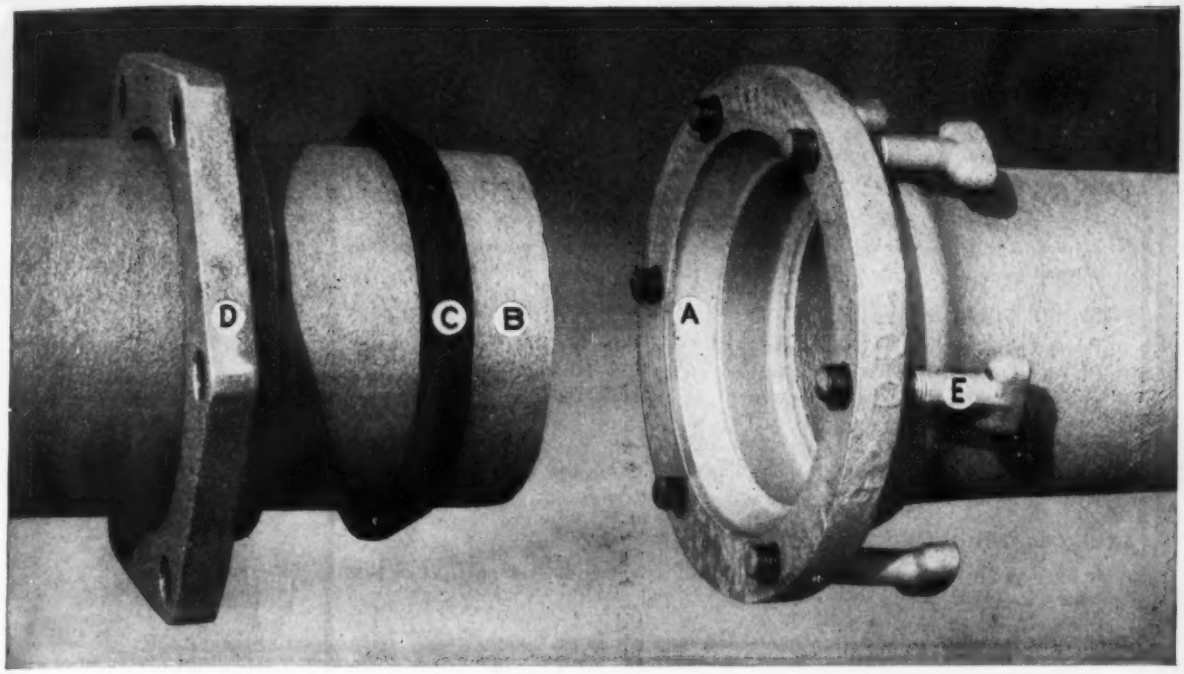
(A SUBSIDIARY OF RECONSTRUCTION FINANCE CORPORATION)

RFC OFFICES (INCLUDING FORMER DEPARTMENT OF COMMERCE REGIONAL SURPLUS PROPERTY OFFICES) LOCATED AT: Atlanta • Boston • Chicago • Denver • Kansas City, Mo. • New York • Philadelphia • San Francisco • Seattle • OTHER RFC SURPLUS PROPERTY OFFICES LOCATED AT: Birmingham • Charlotte • Cleveland • Dallas • Detroit • Helena • Houston • Jacksonville • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • Oklahoma City • Omaha • Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • Spokane • OTHER FORMER DEPARTMENT OF COMMERCE REGIONAL SURPLUS PROPERTY OFFICES LOCATED AT: Cincinnati and Fort Worth

155-2

DOUBLEX SIMPLEX JOINT

Justifies Its Cost in Time Saved, User Says



(A) Socket end of pipe (B) Spigot end of pipe (C) Endless ring gasket (D) Cast iron gland (E) Alloy cast iron bolts and nuts

"The additional cost of the mechanical joint pipe was paid for many times by the labor saving, the speed of construction and the elimination of any unnecessary open ditches."

THOUSANDS of miles of Mono-Cast Pipe with Double Simplex Joints have been laid. Almost invariably the conclusion is reached that the slight additional cost of the Doublex Simplex joint over the bell and spigot joint is more than offset by the speed of laying and labor saving. No special skill is required in making up the joints on the job —an ordinary wrench is the only tool necessary.

Mono-Cast Doublex Simplex Pipe, available in diameters 3″ through 48″, is ideal where flexibility, high strength and corrosion resistance are desired, and where a joint that is leakproof under high pressures is required.

Write for catalog of Mono-Cast Doublex Simplex Pipe and fittings.

Note: Mono-Cast Centrifugal Pipe is also supplied with bell and spigot, Screw-Gland, Molox Ball-and-Socket and Roll-on-Rubber Ring Joints.

AMERICAN CAST IRON PIPE COMPANY

Birmingham, Alabama

Chicago Minneapolis Kansas City Los Angeles New York
Cleveland Dallas Houston San Francisco

What do YOU expect of a Gate Valve?

EASE OF OPERATION?

Mueller-Columbian Gate Valves operate smoothly and easily with either Manual, Hydraulic or Electric power because the ball-joint construction prevents any binding of stem.

POSITIVE CLOSURE?

The seat rings are machine finished and ground with absolute parallel faces. The wedging action is applied with equal pressure at four points at the edges of each disc, preventing springing or buckling of the discs.

EASILY INSTALLED?

Due to the four-point contact principle, Mueller-Columbian Gate Valves can be installed and operated in any position with equal efficiency.

SELF-CLEANING?

In opening or closing, the valve discs move back away from the seat rings yet are held close enough to shear off any incrustations.

ONE PIECE GATE ASSEMBLY?

If necessary to remove the complete disc assembly, it may be removed as a unit without falling apart and without removing the valve from the line.

ECONOMY?

Mueller-Columbian Gate Valves have extraordinary thickness of section throughout. All metals used are in strict accordance with the specifications of the American Society for Testing Materials and the American Water Works Association. Each valve is hydrostatically tested to twice the indicated working pressure before shipping. These features make economical maintenance an accepted fact with users. Write us for full information.

GATE ASSEMBLY
(open position)

ELECTRICALLY OPERATED GATE VALVE

HYDRAULICALLY OPERATED GATE VALVE

HAND-OPERATED GATE VALVE WITH BY-PASS

MUELLER CO. CHATTANOOGA, TENN.

Wilson PULSAFEEDER

UP TO 500,000 GALLONS DAILY

For water systems for which peak demand does not exceed 500,000 gallons per day, the Pulsafeeder type of hypochlorinator is more economical and more satisfactory than gas chlorination.

CONTINUOUSLY ADJUSTABLE WHILE IN OPERATION

Rate of feeding with Wilson Pulsafeeders is continuously adjustable, from zero to maximum flow, by simple turning of a micrometer knob on the side of the machine, while Pulsafeeder is in operation. Meter-controlled model is actuated by water meter, provides exactly proportioned feeding at all rates of flow.

HYDRAULICALLY-BALANCED DIAPHRAGM HEAD

Exclusive Pulsafeeder construction is an hydraulically-balanced diaphragm which isolates the piston and cylinder from the chemical solution being pumped. No packing glands required. No corrosive attack on pump parts by chemical solutions.

MULTIPLE-HEAD PULSAFEEDERS

Pulsafeeders are available in models with one, two, three or four heads, all driven by the same motor. Solutions for hypochlorination, ammoniation, algae control, pH control, color, odor or taste control may be fed in any combination, in exactly proportioned rates.

SEALED-IN LUBRICATION

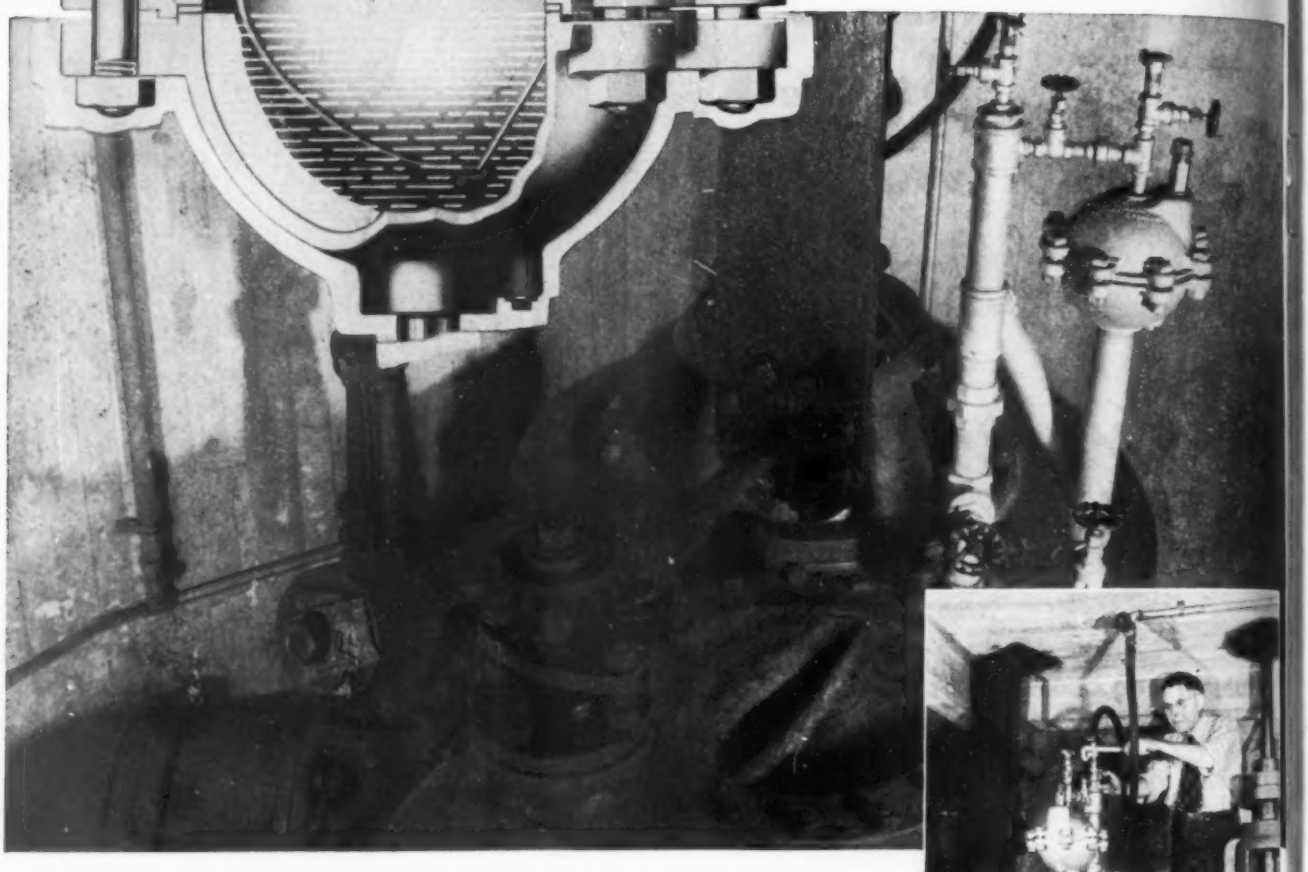
All working parts of the Pulsafeeder—except the motor—are enclosed in a housing and run in an oil bath. Minimum maintenance required, long life assured.

Illustrated literature and specifications—also data sheet for factory recommendations on *your* requirements—available on request. *Process Equipment Division, Lapp Insulator Co., Inc., 116 Maple St., LeRoy, N. Y.*

Lapp

The SIMPLEX AIR RELEASE VALVE

ELIMINATES SEWAGE PUMP SHUTDOWNS and MAINTAINS PEAK EFFICIENCY



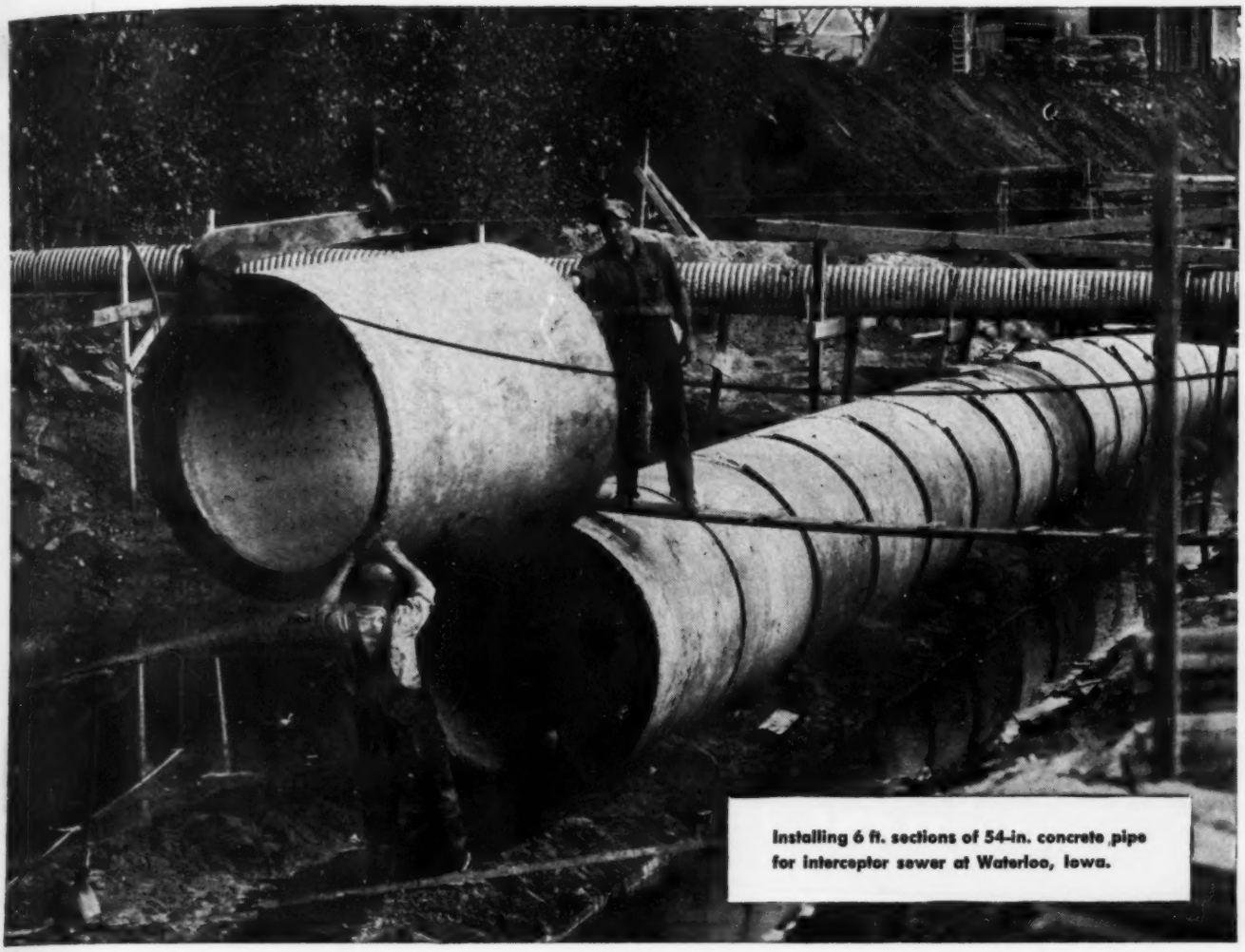
FORMERLY, complete shutdown at least once a day — now, easy routine flushing* once a week! Simplex Air Release Valves at the Pottstown Sewage Works maintain peak operating efficiency of sewage lines and pumps — eliminate frequent and costly shutdowns caused by trapped air and gases from decomposing organic matter.

Simplex Type "B" Valves are especially designed to meet the particular conditions of sewage service. Construction is simple and dependable. There is but one lever movement which operates a needle valve so designed as to be always tight-seating. The valve is operated by a heavy thickness glass ball float, tested to several times the service working pressure. A cast iron shell houses the actuating parts which are of corrosion-resisting materials.

Simplex engineers will gladly assist in the solution of your sewage flow problems. Write today for details.

**Routine weekly back-flushing at Pottstown Sewage Disposal Works, Pottstown, Pa., accomplished merely by opening the valve below hose connection shown to allow clear water to fill the release valve and the system. Flush is quickly and easily completed without dismantling any part of the installation.*

SIMPLEX VALVE & METER CO.
6743 UPLAND STREET, PHILADELPHIA 42, PENNA.



Installing 6 ft. sections of 54-in. concrete pipe for interceptor sewer at Waterloo, Iowa.

CONCRETE PIPE

Assures Long Service At Low Annual Cost

You can specify concrete pipe for drainage, sanitary sewers or water lines with perfect confidence because the efficiency and durability of concrete pipe lines under the hardest service, have been demonstrated in thousands of installations all over the country, many for more than half a century.

Concrete pipe has proved that it provides:

AMPLE STRENGTH to resist heavy loads and impacts.
MAXIMUM HYDRAULIC CAPACITY due to clean joints and smooth interior surface.
MINIMUM INFILTRATION AND LEAKAGE assured by tight joints and uniformly dense concrete.
HIGH WEAR RESISTANCE to abrasion from suspended grit.

These superior qualities plus the long life, moderate first cost and low maintenance expense of concrete pipe lines, assures *low annual cost*—the true measure of economy in pipe lines.

This Association or any of its members will gladly furnish technical information to assist in planning concrete pipe installations.

(List of our members on request.)

AMERICAN CONCRETE PIPE ASSOCIATION

228 N. LaSalle St., Chicago 1, Illinois — 342 Munsey Bldg., Washington 4, D. C.

BUY U.S. SAVINGS BONDS

*APPROVED

"Varec"

PRESSURE RELIEF & VACUUM BREAKER VALVE

WITH FLAME ARRESTER

FOR

SEWAGE GAS CONTROL

This is a complete vent unit consisting of a pure aluminum Pressure Relief and Vacuum Breaker Valve with Flame Arrester, entirely self-contained and fully protected from the elements. It is non-corrosive in sewage gas, and electrolysis is eliminated, as the potentials of all component parts are in equilibrium. Ease of inspection and maintenance is a special feature. Skilled engineering plus careful manufacture assures consistent, trouble-free operation. The new "VAREC" Sewage Gas Control Handbook S-3 shows the complete line, as well as giving information and facts of value to sanitation engineers. Write for your copy today.

***"VAREC" VENT EQUIPMENT**

Is listed by:

The Underwriters' Laboratories for use on Oil Storage Tanks.

Approved by:

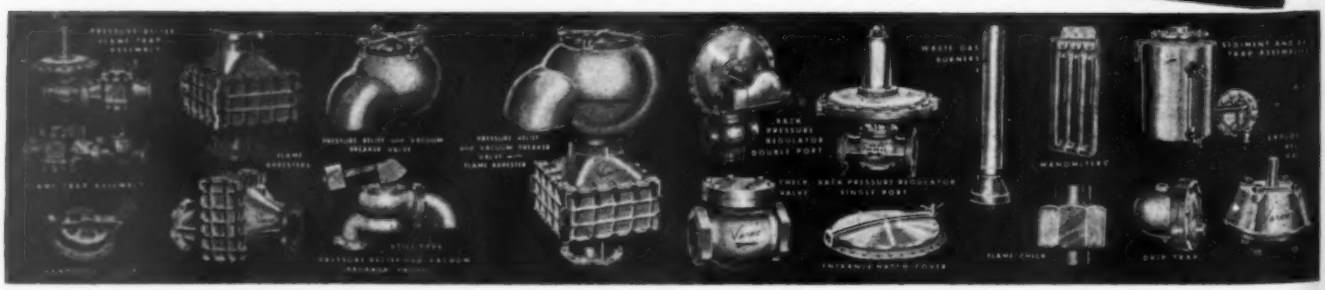
Associated Factory Mutual's Laboratories
U. S. Treasury Department
U. S. Coast Guard
American Bureau of Shipping
Lloyd's Register
U. S. Navy
U. S. Army Engineers

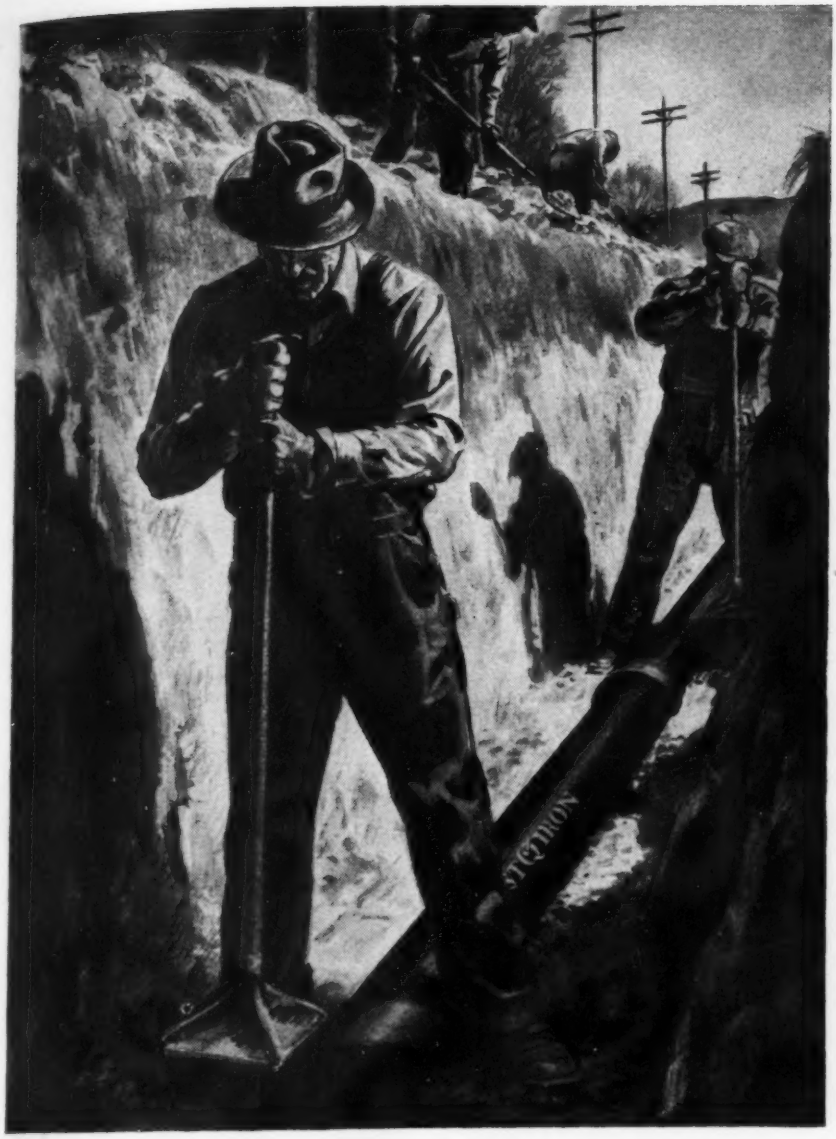
Depending upon which is the governing authority

THE VAPOR RECOVERY SYSTEMS COMPANY
COMPTON, CALIFORNIA

NEW YORK CITY—CHICAGO, ILL.—HOUSTON, TEX.—TULSA, OKLA.
Agencies Everywhere—Cable Address VAREC-COMPTON (All Codes)

6-1





A cast iron main, properly laid, comes as close to permanent construction as can be predicted in a changing world. Since its useful life is measured by centuries it need never be replaced except as a larger main is required by population growth, and need never be abandoned should the line be re-routed because of shifting population. It will serve out its full span in the original location or elsewhere. And when it is just settling down to the prime of life, any bonds issued to pay for the installation will have long since been retired and forgotten.

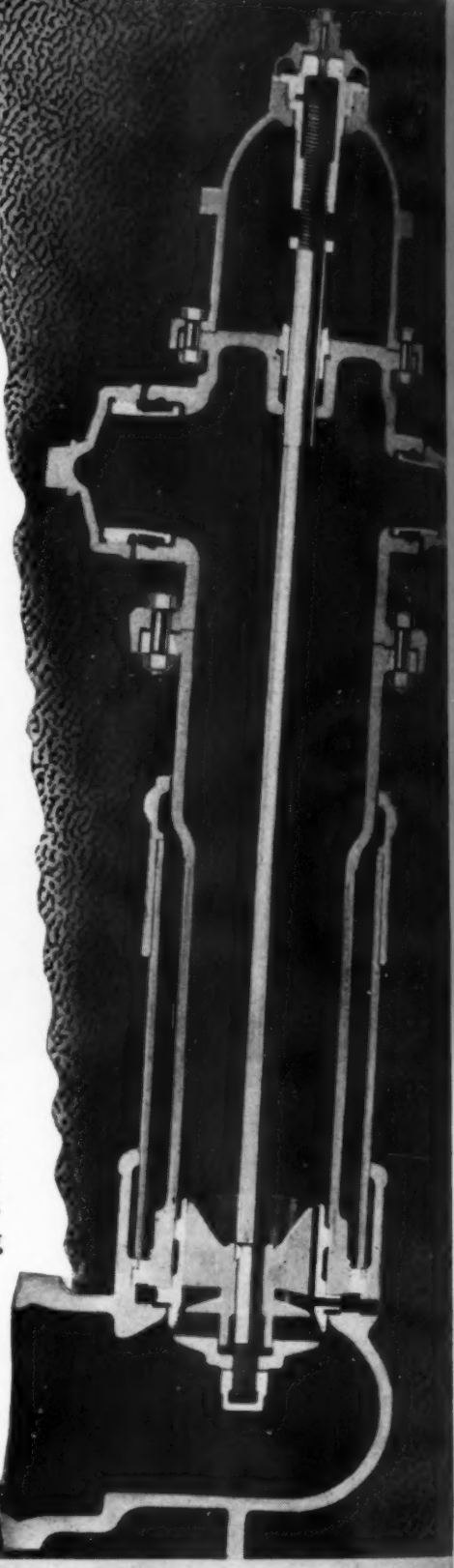
CAST IRON PIPE RESEARCH ASSOCIATION, T. F. WOLFE, ENGINEER, 122 S. MICHIGAN AVE., CHICAGO 3

CAST IRON PIPE
SERVES FOR CENTURIES

LET FROST HEAVE HO!

When frost heaves the earth, the Mathews protection case grows . . . up it comes in the ground . . . without disturbing the barrel, the member that contains all the working parts . . . and preventing the joint from breaking. As to the barrel: If damaged, it is drawn out and a spare barrel inserted . . . no excavating . . . no breaking of the pavement . . . no waste of time, with the attendant peril to life and property. As to the protection case: It's Sand-Spun (centrifugally cast) . . . purified in the process, freed of strains, strong, elastic.

And note these Mathews features: Oiled from the outside; nozzle raises or lowers; head rotates a full circle; leak-proof stuffing-box plate cast integral with the barrel . . . assuring dry, non-freezing operating thread; low-placed orifice, draining out all the water, preventing any freeze-up. These and other outstanding qualities have made Mathews the preferred hydrant all over the world for more than 75 years.



MATHEWS HYDRANTS

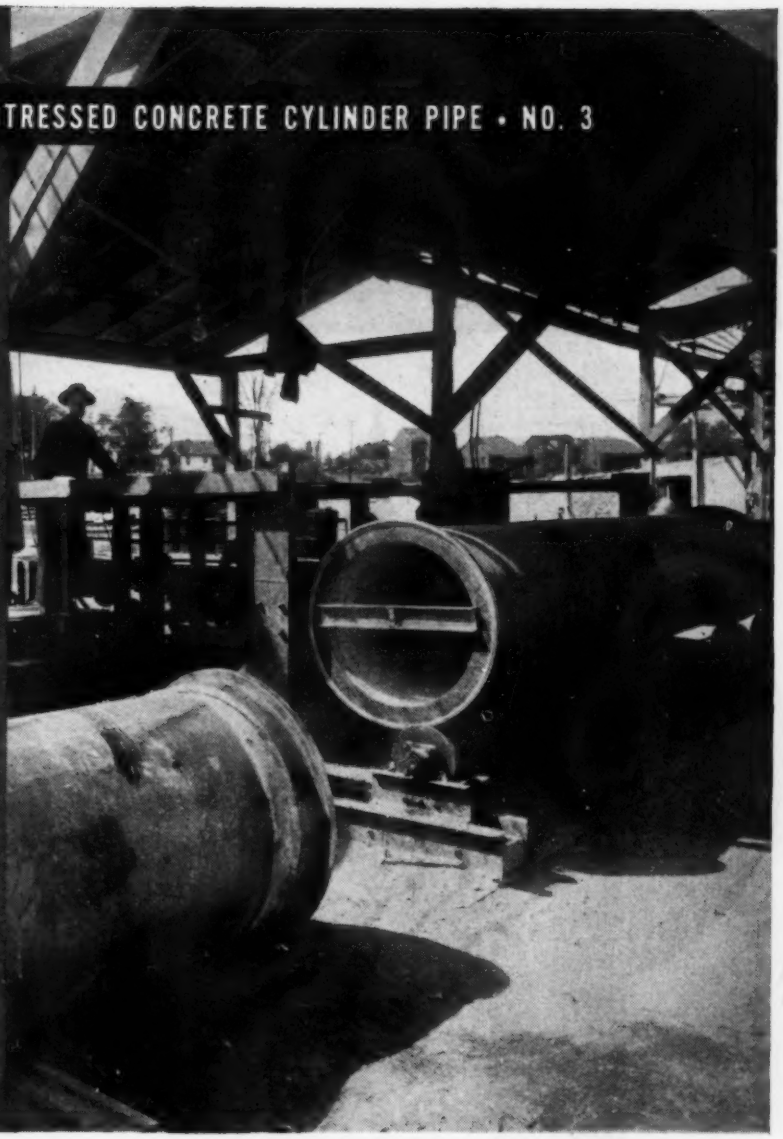
Made by **R. D. WOOD** *Company*

PUBLIC LEDGER BUILDING
INDEPENDENCE SQUARE, PHILADELPHIA 5, PA.

MANUFACTURERS OF SAND SPUN PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES

ADVANTAGES OF PRESTRESSED CONCRETE CYLINDER PIPE • NO. 3

Greater Elasticity



• Lock Joint Prestressed Concrete Cylinder Pipe has many advantages . . . and among its most important qualities is GREATER ELASTICITY.

Tests have proven that *prestressing* produces elastic properties in a reinforced concrete structure, previously unattainable with conventional designs, and it is only through *prestressing* that the wider range of elastic properties of high tensile wire can be used to the greatest advantage. The winding of the wire under tension around the "core" causes an initial compression in the concrete lining, thereby giving the finished pipe a much greater range of elasticity to withstand internal pressure, water hammer and overloads.

During the past few years, the Lock Joint Pipe Company has installed hundreds of thousands of feet of Prestressed Concrete Cylinder Pipe with several hundreds of thousands of feet now under contract. When you specify this high pressure pipe you can count 100% on strength, economy and performance.

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

LOCK JOINT PIPE COMPANY

Established 1905

P. O. BOX 269, EAST ORANGE, NEW JERSEY

Denver, Colo. · Chicago, Ill. · Kenilworth, N. J. · Kansas City, Mo. · Rock Island, Ill. · Joplin, Mo. · Valley Park, Mo. · Cleveland, Ohio · Hartford, Conn. · Navarre, Ohio

SCOPE OF SERVICES — *Lock Joint Pipe Company specialises in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

FROST CAN'T BUDGE A SMITH HYDRANT

THE TAPERED BARREL BREAKS THE GRIP

The tapered barrel of the SMITH Protectop Hydrant prevents frost-swollen ground from gripping the barrel, heaving it upward, dislocating the hydrant, and straining the connections. As the earth rises with expansion, it slides upward along the narrowing taper of the barrel, releasing the grip.

Only SMITH *has all of these* FEATURES

1—*Positive action drain;* always closed when the main valve is open, opening, or even partially open. When the main valve is closed the drain is always open.

2—*Low friction loss.* Barrel cross-section exceeds valve area by 200%.

3—*Protectop breakable coupling.* Patented coupling construction confines breakage to quickly and inexpensively renewed parts.

4—*Quick accessibility.* All working parts are easily removed and replaced, without excavation.

FIRE HYDRANTS
GATE VALVES
CHECK VALVES
INSERTING VALVES
TAPPING SLEEVES AND VALVES
WATER SERVICE BRASS GOODS

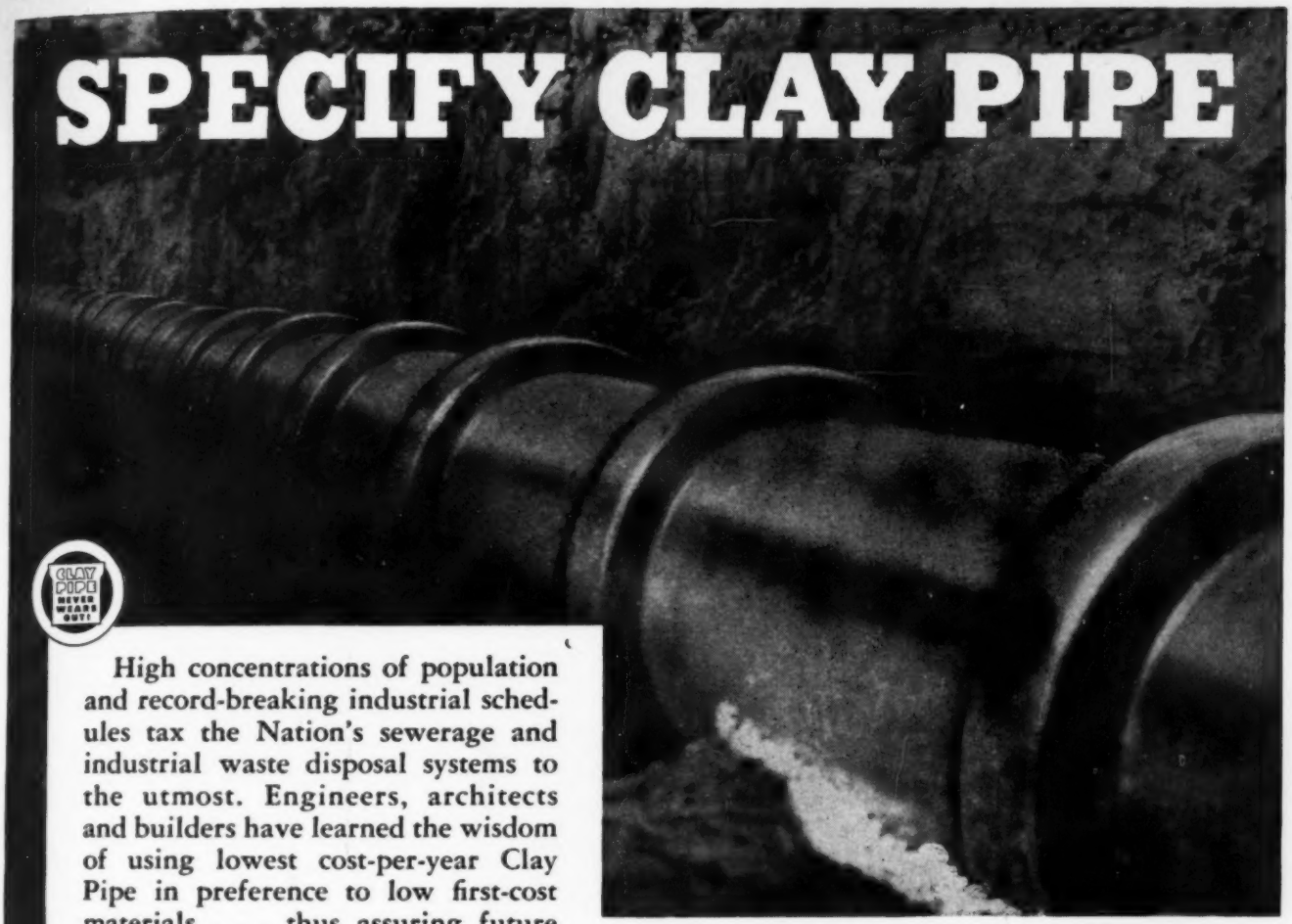
THE A. P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

FLOOR STAND
INDICATOR POST
TAPPING MACHINE
INSERTING MACHINE
PIPE CUTTING MACHINE
CORPORATION TAPPING MACHINE

FOR LOWEST COST-PER-YEAR PLUS TOP PERFORMANCE . . . . .

SPECIFY CLAY PIPE



High concentrations of population and record-breaking industrial schedules tax the Nation's sewerage and industrial waste disposal systems to the utmost. Engineers, architects and builders have learned the wisdom of using lowest cost-per-year Clay Pipe in preference to low first-cost materials . . . thus assuring future performance as well as meeting immediate needs.

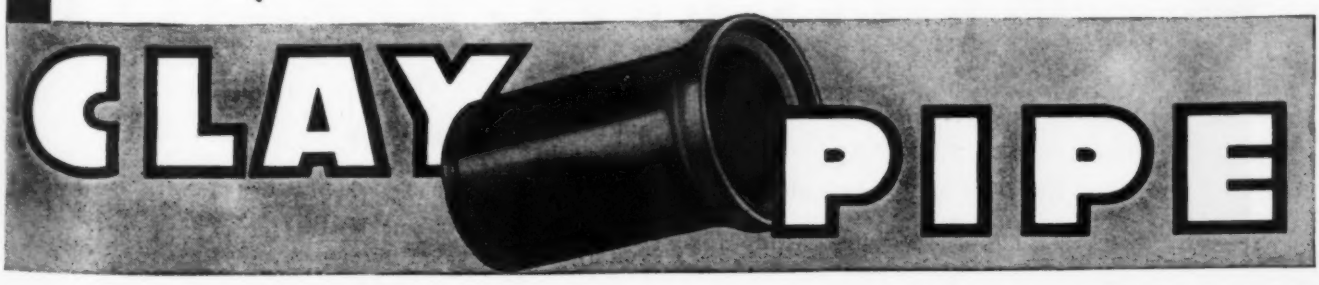
Clay Pipe installations cost less-per-year because Clay Pipe lasts longer than any other pipe . . . it never wears out. Molded of nature's most enduring raw material, vitrification under intense heat permanently bonds the elements into the tough, finished Clay Pipe that serves so well.

Only Clay Pipe is unaffected by acids, alkalies, gases and abrasion. That is why Clay Pipe is the only safe long-run pipe for carrying sewage and industrial wastes. That is why more Clay Pipe has been used, and is being used, for these purposes than any other kind.

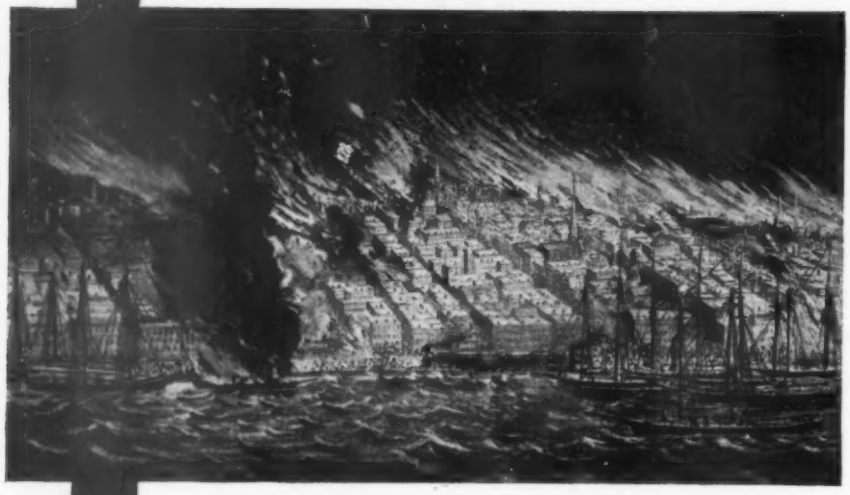
For Information or Engineering Literature from one of the regional association offices, write to:

National Clay Pipe Manufacturers, Inc.
111 W. Washington St., Chicago 2, Ill.

C-246-4

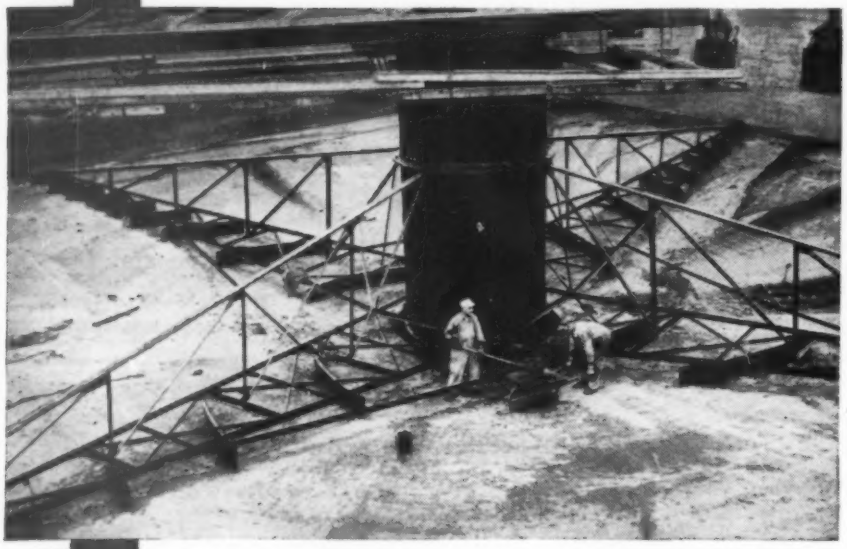


Famous Facts



Beginning Sunday evening, October 8, 1871, fire raged through Chicago until checked by rain a day and a half later. In that brief time, five square miles of property, valued at $200,000,000 were destroyed.

Even then, corrosion — a slower, less spectacular form of oxidation, but a major threat to underground and underwater metal surfaces — had met its match. Bitumastic Enamel, the first product of its kind, had established unrivalled leadership as protective coating for steel, iron and concrete structures in many industries.



Concrete tanks and steel structures in sewage equipment receive maximum protection from Bitumastic No. 50.

A more recent addition to the Bitumastic line is Bitumastic No. 50, formulated for long-lasting protection of water and sewage plant equipment against the exceptionally severe action of moisture, acid and alkali fumes. A heavy-duty, cold applied coating, it withstands atmospheric temperatures from minus 10° F. to 140° F., without cracking or sagging. It can be easily applied in an unusually thick film, giving maximum protection to concrete and metal surfaces of many types of sewage plants and structures.

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CORPORATION

WESTFIELD, NEW JERSEY

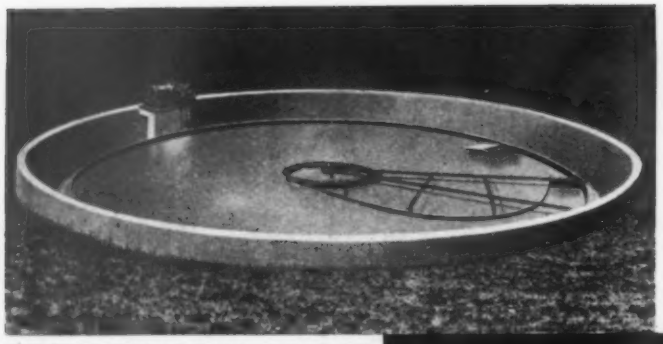
New York 4 • Philadelphia 8 • Cleveland 14 • Chicago 3 • Houston 2 • Tulsa 3 • Miami 36
San Francisco 10 • Los Angeles 1

Original Woodcut by Lynd Ward

There's a solid satisfaction in specifying cast iron pipe. You know that your choice coincides with the judgment of leaders of your profession the world over. And when the line is backfilled, you are confident that it will serve throughout a long life at a low annual maintenance cost. This has been true of cast iron pipe for centuries; yet in the forty-odd years since our Company was founded, notable advances in manufacturing methods and controls have been made, resulting in a finer, more uniform pipe, either pit cast or centrifugally cast.

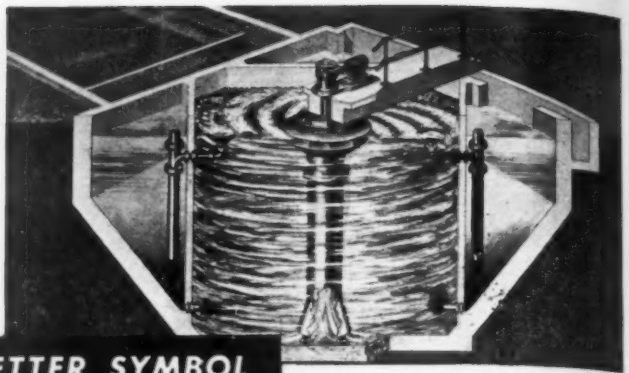
U.S.
cast iron
PIPE

U. S. PIPE & FOUNDRY CO.
General Offices: Burlington, N. J.
Plants and Sales Offices throughout the U. S. A.



YEOMANS "RIM-DRIVE" CLARIFIER MECHANISM

Smart in appearance, economical in service. Motor and drive unit mounted on rim of the tank. Cuts torque demand 95%. Simple, efficient, accessible. Bulletin 6710.

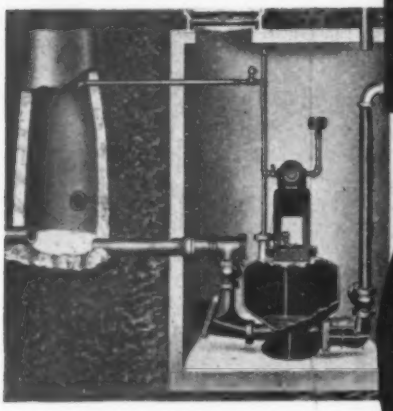


YEOMANS "AERIFIER"

Aeration and final settling in one concrete structure — simple design, with a minimum of working parts to require maintenance attention. Bulletin 6650.

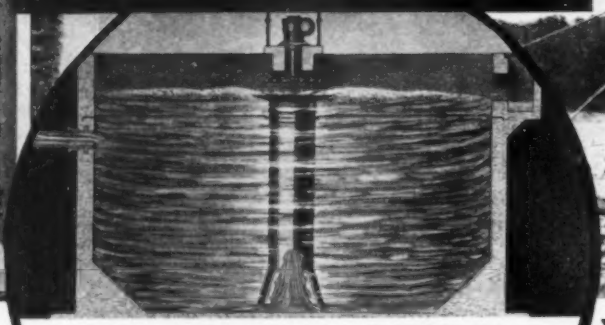
THERE'S NO BETTER SYMBOL OF RELIABLE, ECONOMICAL, TROUBLE-FREE PERFORMANCE THAN THE NAME

YEOMANS



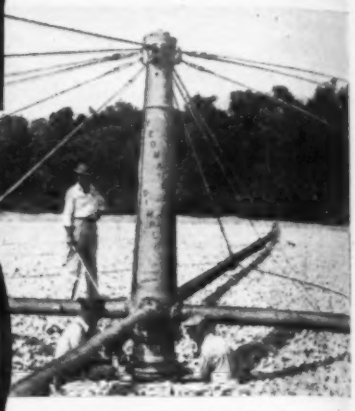
YEOMANS "SHONE" EJECTOR —STANDARD OF EFFICIENCY

Automatic, clog-proof, fool-proof, this famous unit has back of it a 75-year record for utter reliability. No screens or shredders, no wet well, the sturdy Shones are good news to maintenance men. Bulletins 4003, 4301, 4401.



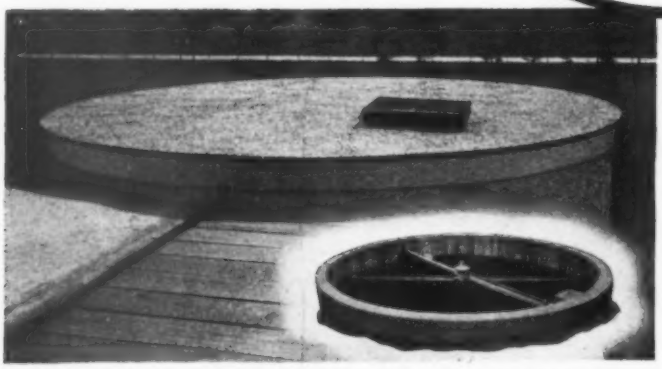
YEOMANS "SPIRALFLO" AERATOR

Low power consumption and thorough "Spiralflo" mixing combine to make an aerator that can't be excelled for high purification values and low operation and maintenance costs. The original design and still the best. Bulletin 6601.



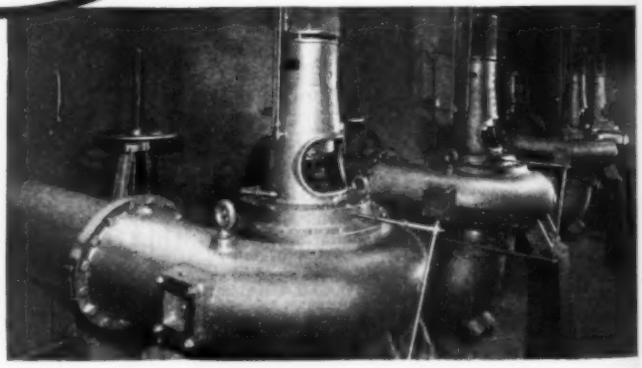
YEOMANS ROTARY DISTRIBUTOR WITH "LEVELER"

When filter beds settle and distributors fall out of plumb, the "Leveler" comes to the rescue. A simple adjustment with ordinary wrenches realigns a Yeomans distributor equipped with the "Leveler", saves big expense. Bulletin 6502.



YEOMANS "WATER-WHEEL DISTRIBUTOR

A remarkable record of unfailing performance with minimum attention proves this well-designed unit's fitness for small communities, institutions and industrial plants. Easy and inexpensive to install and maintain. Bulletin 6552



YEOMANS SEWAGE PUMPS

In every type of sewage pumping installation Yeomans centrifugal pumps are giving the sturdy, trouble-free service expected of them. A full range of sizes and types—vertical and horizontal—to meet every need. Bulletin 6201.

Yeomans Brothers Company

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hope they don't start using

PITTCHLOR

Chlorine-susceptible microorganisms, bacteria and algae succumb quickly when they encounter PITTCHLOR. A high-test calcium hypochlorite containing a minimum of 70% available chlorine, PITTCHLOR is highly effective for the chlorination of water supplies . . . for the treatment of sewage . . . and for disinfection, deodorizing and general sanitation. Easy and economical to use.

Stocked by leading jobbers—5 lb. resealable cans (9 per case), 3¼ lb. cans (12 per case) and 100 lb. drums.

Send for descriptive literature.

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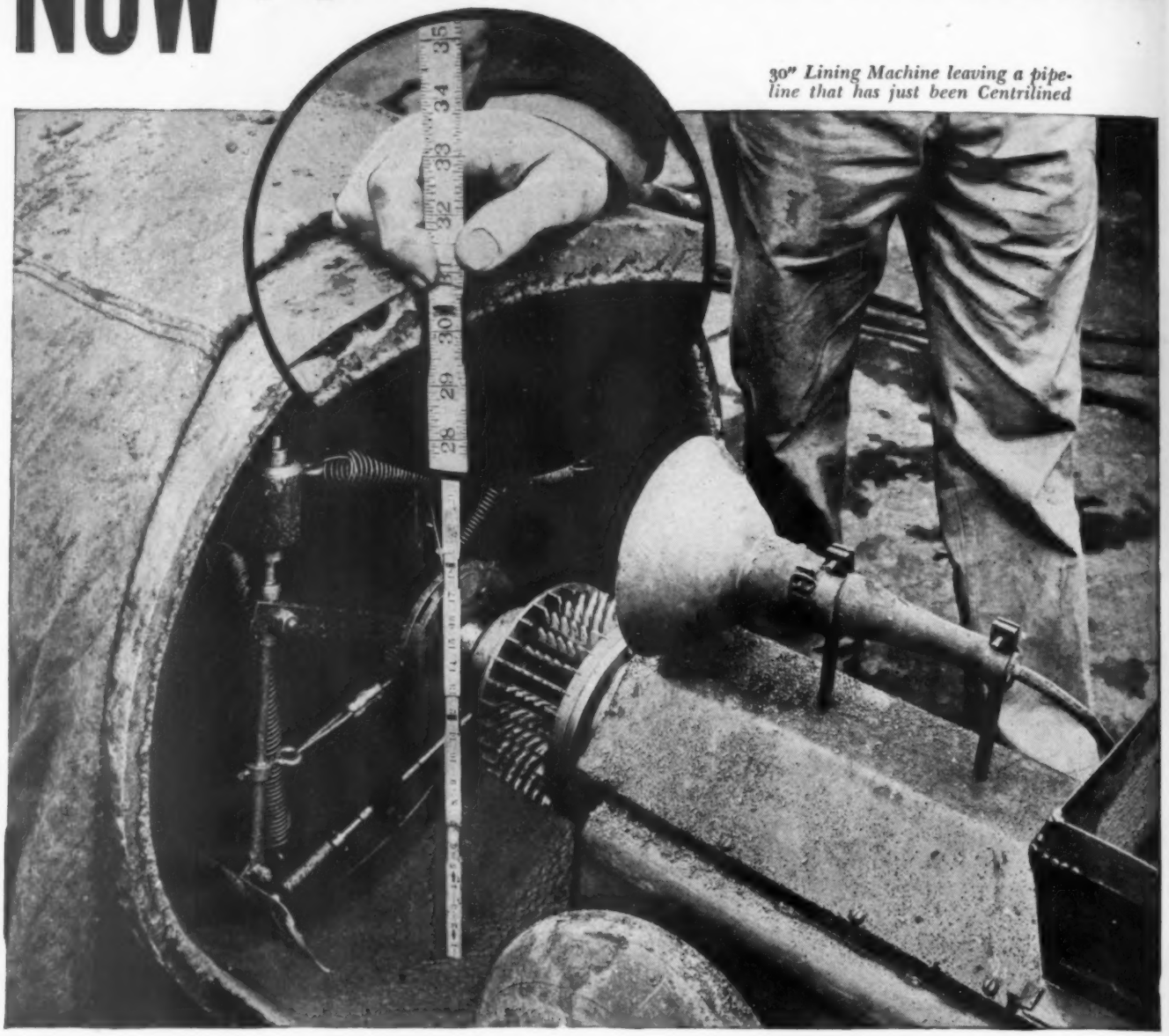
Soda Ash· Caustic Soda· Liquid Chlorine · Sodium Bicarbonate · Pittchlor · Silene EF (Hydrated Calcium Silicate) · Calcium Chloride · Soda Briquettes (Iron Desulphurizer) · Modified Sodas · Caustic Ash · Phosflake (Bottle Washer)· Calcene T (Precipitated Calcium Carbonate)

NOW pipes as small as 30 inches



30" Lining Machine leaving a pipe-line that has just been Centrilined

. . . . reconditioned by Centriline

Here's good news! If the diameter of your pipeline is 30" or more . . . whatever its length . . . wherever situated —Centriline men and equipment can quickly reach and recondition it.

The Centriline process is a rapid and economical method of reconditioning pipelines. It consists of cleaning the main and applying by centrifugal force, a dense cement mortar lining of required thickness, mechanically troweled to a smooth finish. This new coating will permanently resist the invasion of tuberculation and corrosion—and will restore and maintain a high carrying capacity.

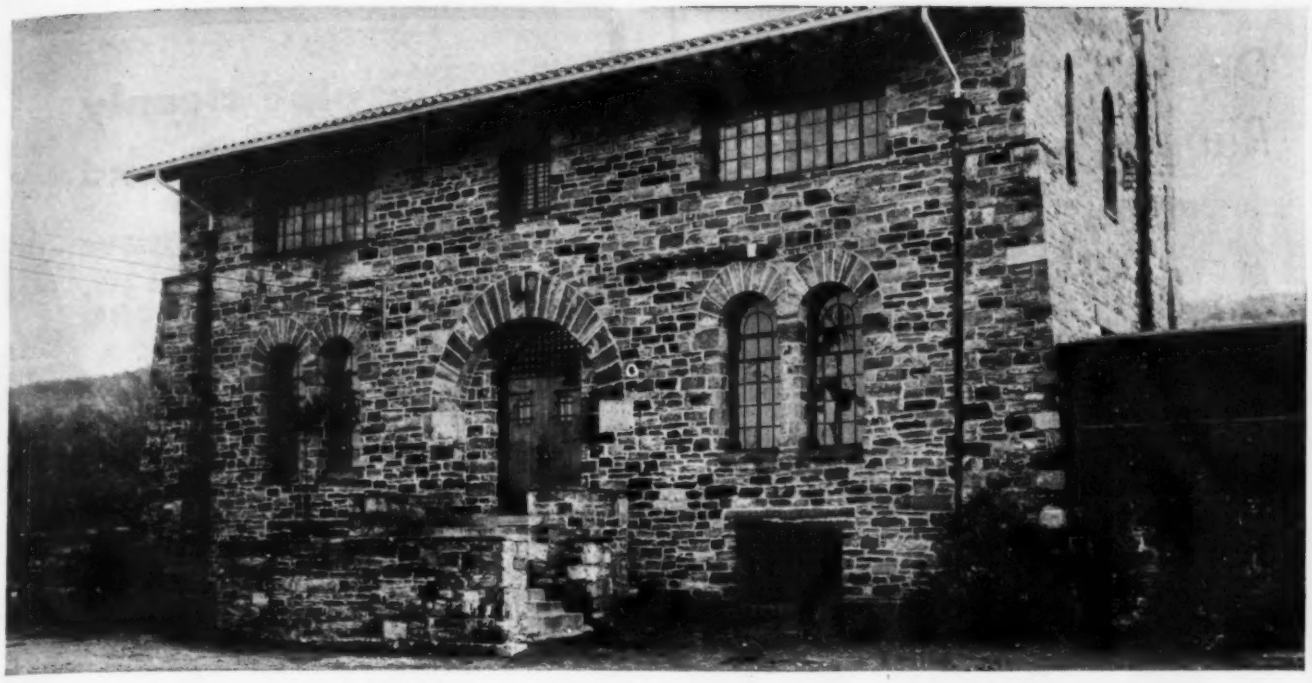
Don't wait until it's too late . . . let Centriline clean and re-line your pipelines now. In that way you'll safeguard your initial investment.

The sleek new lining of a pipe that has been Centrilined

CENTRILINE CORPORATION

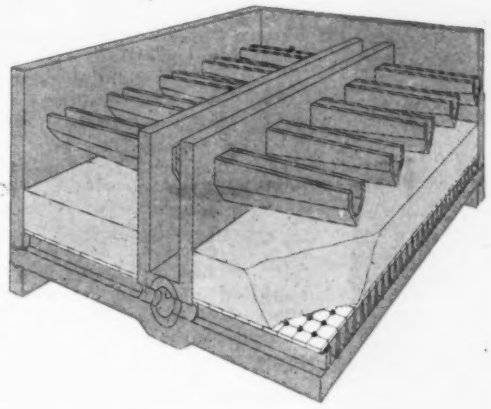
148 CEDAR STREET, NEW YORK 6, NEW YORK

Restores and Protects Pipe-Line Carrying Capacity



CITY OF FORT SMITH, ARK., WATER DEPARTMENT—Jay Medlen, Commissioner—A. H. Ulrich, Chemical Engineer

Solved one problem... realized several "hidden benefits"



Three filters at this plant were equipped with ALOXITE aluminum oxide porous underdrain plates to combat one specific problem.

A light, slowly settling algae floc frequently clogged the filters placing them under a negative head. Moreover, air from the air saturated water at atmospheric pressure was bound in the underdrains. With graded gravel support back washing was a delicate operation requiring much time and close attention. Even so the entire filter beds were often excessively agitated—badly mixing the sand and gravel.

The use of ALOXITE plates corrected this trouble immediately... by eliminating the gravel. But other benefits occurred too.

An even washing and filtering rate is now maintained with these porous plates. Previously there was a common tendency for perforated cast iron laterals placed beneath the underdrains to clog and upset operation.

There is also a distinct saving in the ease with which ALOXITE underdrain plates are maintained... as well as in lower cumulative operating costs. And an authoritative statement reads "We feel satisfaction in knowing the sand beds in these filters are in better condition than in gravel supported beds."

At your request our engineers will gladly provide complete information on the ALOXITE porous underdrain system. Write Dept. O-36, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.

Underdrain Plates

BY CARBORUNDUM

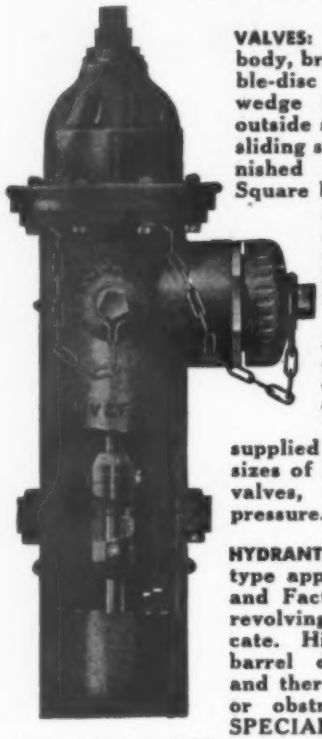
TRADE MARK

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

Dependable!
Rugged!

MH

VALVES
HYDRANTS



VALVES: A.W.W.A. type, iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position. All rugged and dependable, made of best material with highest quality workmanship.

Hydraulically Operated: For remote control of operation and for quicker, easier opening or closing. Can be supplied in any of the standard sizes of M & H A.W.W.A. gate valves, either high or low pressure.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals. Dry top, revolving head, easy to lubricate. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway. SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem.

Write for Catalog No. 34

M & H PRODUCTS INCLUDE

FIRE HYDRANTS	SHEAR GATES
GATE VALVES	MUD VALVES
TAPPING VALVES	VALVE BOXES
WALL CASTINGS	FLAP VALVES
SPECIAL CASTINGS	SLUDGE SHOES
TAPPING SLEEVES	FLANGE AND FLARE FITTINGS
CHECK VALVES	FLANGED FITTINGS
FLOOR STANDS	B & S FITTINGS
EXTENSION STEMS	CUTTING-IN TEES

M & H VALVE
AND FITTINGS COMPANY

ANNISTON, ALABAMA

Cut your pipe cleanly with more ease and speed with this new efficiency-balanced

RIDGID

PIPE CUTTER

. . . with fast-action thin-blade cutter wheel

● Slap this new RIDGID Cutter on a pipe, turn it tight and roll it right through your pipe in a few easy turns — thin wheel leaves practically no burr. You like the well-balanced feel of its new style malleable frame and the thin blade tool-steel wheel always cuts true—every cutter individually tested to assure it. Your choice of 5 sizes to 6" capacity and 4-wheel cutters to 4." For easier pipe cutting order RIDGIDs, at your Supply House.

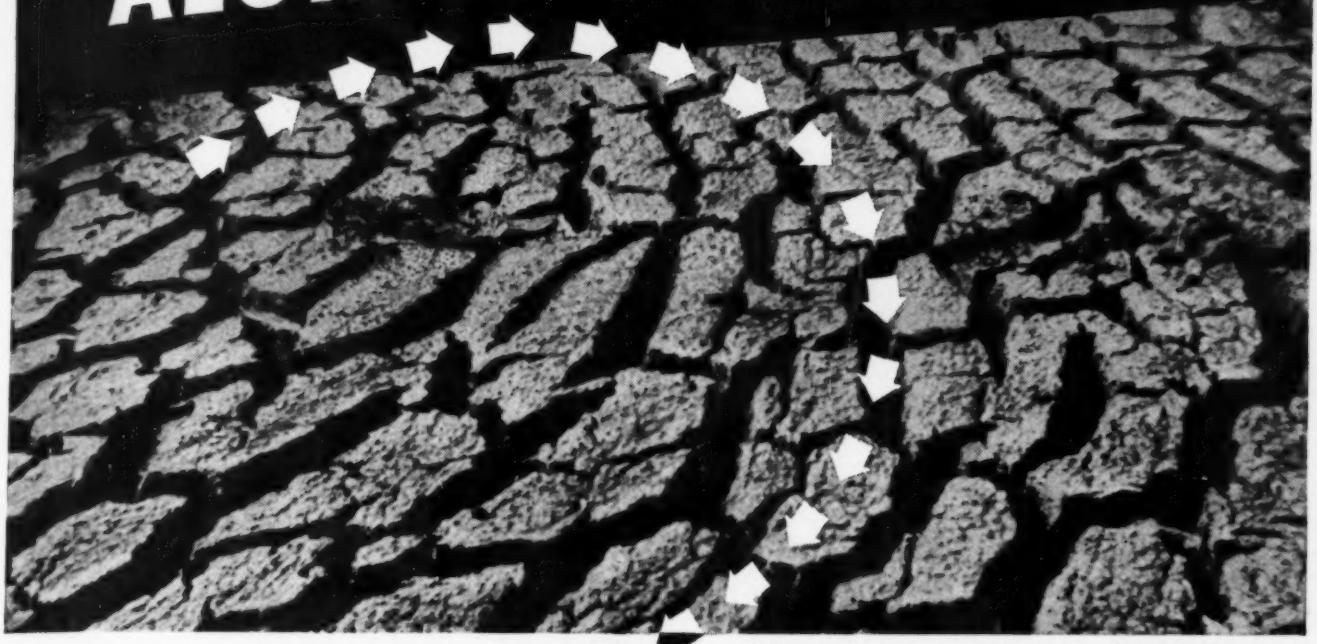
4-wheel No. 42 for fast quarter-turn cutting.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U. S. A.

GENERAL CHEMICAL ALUMINUM SULFATE



Well cracked sludge bed shortly after Aluminum Sulfate treatment.

SPEEDS SLUDGE DRYING

General Chemical Alum speeds sludge dewatering and drying on sand beds . . . capacity of beds may be doubled, even tripled . . . quick removal lessens chance of odor nuisance . . . reduced volume of cake decreases cost of removal. Sewage works operators the nation over count on the benefits obtained from Alum treatment throughout the year.

Why not learn what General Chemical Alum will do in your plant too? Full information may be obtained quickly from the nearest General Chemical Sales and Technical Service Office listed below.

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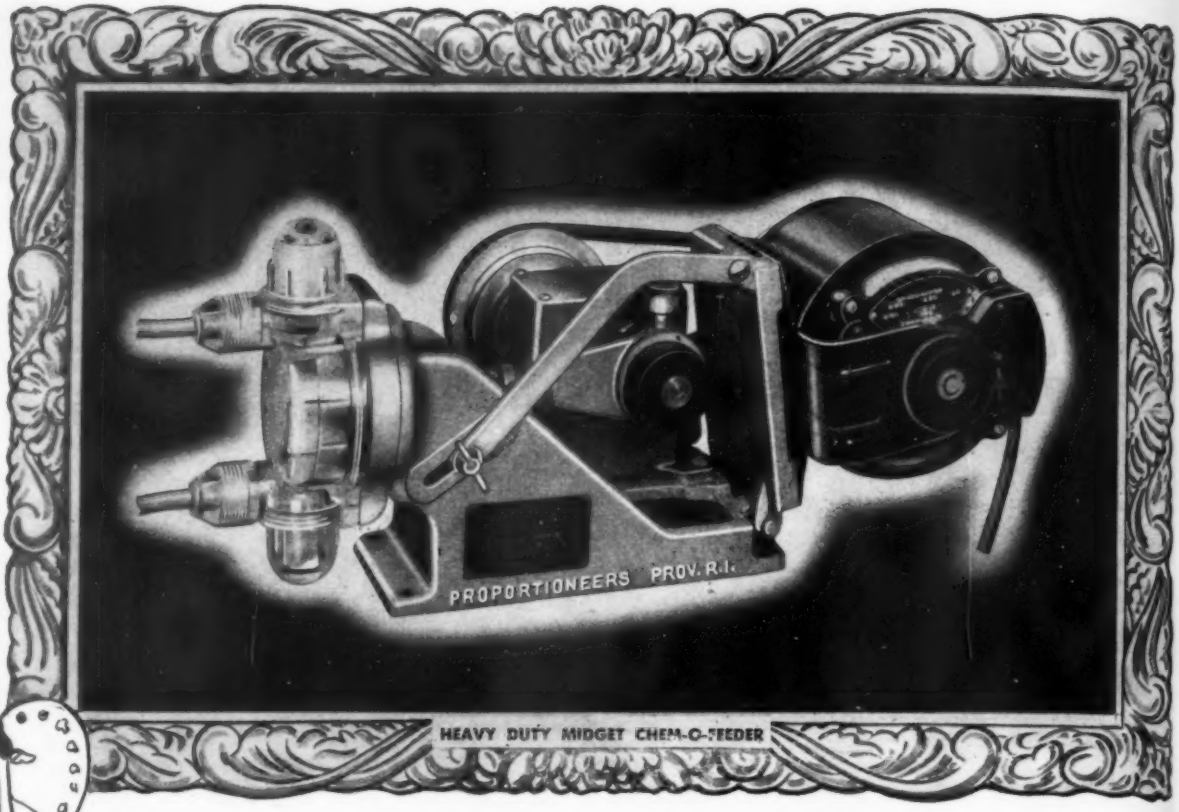

Portrait of a Dependable Chemical Feeder

DESCRIPTION

The Heavy Duty Midget Chem-O-Feeder is a constant rate-of-feed, diaphragm pump equipped with a "See-Thru" plastic reagent head and driven by a 1/6 h.p. 1750 RPM electric motor. The feeding rate is adjustable by means of a duplex eccentric cam regulating the stroke length and by shifting the belt in the three-step cone pulley for adjusting the stroking speed.

SPECIFICATION:

Stroke length: adjustable from .05 to 0.2".
Delivery per stroke 1.5 CC to 10.6 CC.
*Stroking rate: 13, 26 and 48 strokes per minute.
Reagent delivery: Approx. 19.5 to 509 CC per minute — *0 to 8 gallons per hour at atmospheric pressure — *0 to 7.4 gallons per hour at maximum pressure of 85 lbs.

★ Based on use of 1750 RPM motor and 50 to 1 speed reducer. Increased capacities can be obtained by using lower ratio speed reducer.

CHEMICALS HANDLED

Calcium and Sodium Hypochlorite • Calgon • Sodium Phosphate • Aluminum Sulphate • Aqua Ammonia Sodium Carbonate • Lime Slurry • Carbon Slurry Ferric Chloride • Etc.

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SHIPPING INFORMATION:

Net weight	72 lbs.
Gross weight	105 lbs.
Box size	13" x 16" x 29"
Shipment	1-3 weeks

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E. S. GILLETTE, Publisher
330 South Wells Street, Chicago 6, Ill.

COMING!

"Orifices—Their Selection and Use"

At long last we are able to print this contribution, promised several months ago. A reference type of article, it is an ideal addition to our 1946 Reference and Data Number which this year will be our April issue in order to have it for distribution during the AWWA Convention in St. Louis May 6-10. Those familiar with his earlier contributions will be anxious to have this veritable handbook on "Concentric Orifices" by—
D. R. TAYLOR, Superintendent
Roanoke, Va., Water Department.
(Until recently Major, U. S. Engineers)

"Stop Guesswork in Copper Applications"

Is the theme of an article describing how by a simple procedure of alkalinity titration, as the basic factor, the correct dosage of copper sulphate may be determined. A history of the effectiveness of the scheme over a period of years, without over or under treatment, is related by—
WM. D. MONIE, Chemist,
Commonwealth Water Co., Summit, N. J.

"Cavitation in Pumps"

In an excellent discussion of the phenomena and truths concerning cavitation in centrifugal pumps, this paper reveals some misconceptions generally held concerning the causes of cavitation, and suggests methods of correction of this noisy and destructive condition, which is more commonly experienced than is generally realized. The author is—
ROBERT W. ANGUS, M.E., Prof. Emeritus.
Dept. of Mechanical Eng., Univ. of Toronto.

"Mathematics for Water and Sewage Works Operators"

Is a fundamental presentation of what every good operator should know about fractions, decimals, percentage, proportion, physical units, rates, significant figures, graphs, logarithms, solutions, elementary hydraulics, averages, and other mathematical operations which plant operators may need to conduct from time to time. This treatise on "Applied Mathematics for Plant Operators" is to run as a series of "lessons," rather than as a simple article. The author is—
DR. WARREN EGLOF, Prof. Chemical Engineering,
Niagara University, New York.

"A New Concept of Coagulation"

Has been developed from considerations of gel formation and syneresis. Called the "protogel" theory, its application to the mechanism of coagulation and floc formation is compared to the current agglomeration theory by its proponent—
HAROLD R. HAY, Chemical Engineer,
Philadelphia Quartz Co., Phila., Pa.

"Straight From Our Readers"

Is another chapter on what our readers think and say about problems confronting water and sewage works. This particular installment is devoted to comments on Corrosion.

"Evaluation of Sewage Works Data"

Is a subject that has been discussed by engineers, chemists, and operators. It is a subject that needs thorough consideration if sewage works data are to be useful either as a basis of design, or as an aid to operation. Some concepts of the subject from the point of view of the laboratory analyst and the operator are presented in this discussion by—
DR. GEORGE E. SYMONS, Assoc. Editor,
Water and Sewage Works.

VOL. 93, No. 3 — MARCH, 1946

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WATER & SEWAGE WORKS

VOL. 93, No. 3 MARCH, 1946

A Gillette Publication

COLD WATER VACUUM DEAERATION*

By SHEPPARD T. POWELL
Consulting Chemical Engineer
BALTIMORE, MARYLAND

CORROSION of both ferrous and non-ferrous equipment is widespread and results in enormous losses in all industries. Such problems are caused by numerous factors and, therefore, there is no universal corrective treatment which can be economically justified. The present discussion is related to the correction of certain types of corrosion resulting from accelerated attack on metal, which occurs from the presence of dissolved gases in a relatively cold liquid. The most common objectionable gases in this respect are dissolved oxygen and carbon dioxide, although hydrogen sulphide, and other gaseous products of decomposition are encountered in some instances.

In general, gases obey Henry's law and remain in solution in specific quantities, when the liquid in contact with the gas is under a designated pressure and at a definite temperature. Thus, the concentration of the gas phase will be directly proportional to the concentration in the liquid phase. Exceptions to Henry's law are found if a chemical reaction takes place and the vapor pressure exerted by the gas is thereby reduced to a fraction of the vapor pressure expected by this law. It is obvious, therefore, that when the condition under which this well known physical law operates is changed, the solubility equilibria of the gases and the media are altered. In the present paper, the discussion has been limited to the effects resulting from a controlled change in the pressure conditions.

Historical

Although it has been known for a long time that the removal of dis-

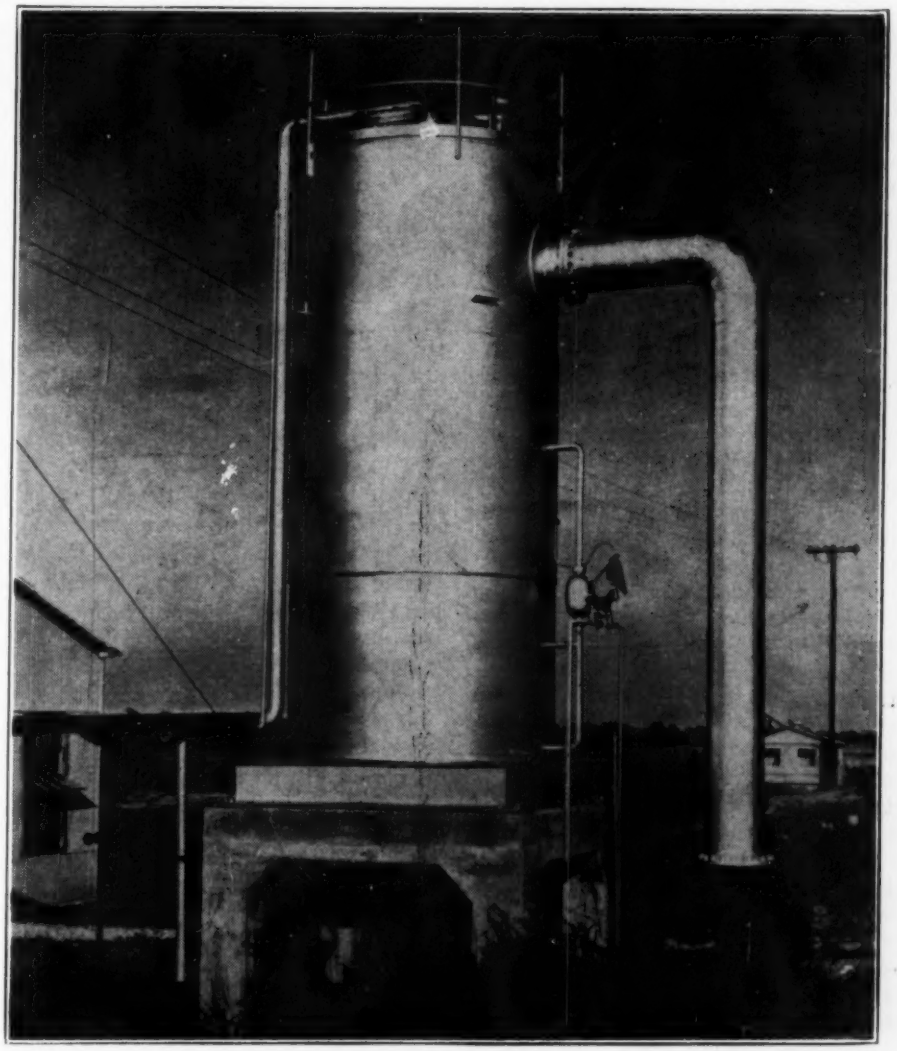

Fig. 1. Deaerating Tank of Freeport Sulphur Co.
(Located at Port Sulphur, La., on Mississippi River, it deaerates water supply for Grand Ecaille Mine 10 miles away.)

*This paper, presented before the Sixth Annual Water Conference of the Engineers' Society of Western Pennsylvania, is here extensively abstracted by permission of the Society.

solved oxygen and other gases from water greatly reduced its corrosive characteristics, degasification of large volumes of cold water received little or no attention until a few years ago. The first large-scale system for such service was designed and installed at Coolgardie in Western Australia for the protection of a 351 mile steel pipe line installed in 1902.[1,2]

This installation consisted of two units, each capable of deaerating three mil. gal. of water per day.

One of the earliest if not the first units in this country was installed at Hotel Haddon Hall[3] in Atlantic City, N. J., about fifteen years ago. A small unit[4] was also installed by the Anti-Corrosion Engineering Co. about 1925 for the Christian Science House near Boston.

So far as is known no large scale deaerators have been constructed anywhere since the one in Australia, until a unit was designed and installed by the Freeport Sulphur Co. at Port Sulphur, La., for deaeration of the Mississippi River water. It was necessary to pump Mississippi River water to the plant since no fresh water was available in the vicinity of the mining operation. The latter unit was built to deaerate approximately 4 mgd. which is pumped approximately ten miles through a steel pipe line. The deaerator was placed in service in 1935, and has been in constant use since that time.

The river water was delivered through a welded steel pipe line, a type of construction which prohibited the use of protective coatings on the inside of the line. Shortly after the mining operations started it was found that the capacity of the pipe line had decreased from its original designed capacity of 4.0 to 3.2 mgd., a reduction of 22 per cent in 129 days due to extensive tuberculation resulting from active corrosion. In view of the fact that pitting had at some places penetrated more than 8 per cent of the thickness of the pipe wall, it was necessary to undertake corrosive measures to inhibit the corrosion and restore the original carrying capacity of the line.

After investigating the several possibilities, a vacuum deaerator was designed to remove the dissolved oxygen from the raw water. A line drawing of this equipment is shown in Fig. 2. Cold water is delivered to the top of the deaerator and distributed over perforated plates. The water then falls vertically through a series of slat bundles to a storage reservoir at the bottom in which the water level is regulated and is delivered directly to the distribution line. Sodium sulphite is injected into the effluent from the deaerator to chemically complete the removal of dissolved oxygen. A vacuum line is connected at the top of the deaerator for the removal of the dissolved gases. It is of interest to note that in this design the water is drawn directly from the reservoir supplying the pipe line into the deaerator by the vacuum created. The vacuum is maintained at 28 to 28½ inches of mercury by an 18 x 7-in. Worthington dry vacuum pump having an overall efficiency of 39 per cent. The use of slat bundles (Fig. 2) is a radical departure from the Coolgardie design and has proven to be much simpler and less costly than the perforated plates used in the Australia installation. A photograph of the completed Port Sulphur deaerator is shown in Fig. 1. This equipment has been in continuous and successful operation for more than ten years.

The Author

Typical Design of Single Stage Unit

The selection and design of a deaerator depends on the specified residual gas required to be maintained in the deaerated water, the physical characteristics of the collection and distribution system, and economics involved for providing such facilities.

In Fig. 3 is shown a large typical deaerating unit designed for treatment of a corrosive water supply for a copper mining operation in Arizona. The cut through the unit illustrates the slat packing, distributor trays and vapor take-off as well as the general arrangement and controls required in such an installation.

Calculated Relations Between Gas Removal Effected and the Vacuum Maintained

Herewith are a number of curves to illustrate the relationships which have been found to exist between deaerator pressure, the residual oxygen in the effluent and the temperature of the water entering the deaerator. The information plotted on these figures has been calculated from oxygen and nitrogen solubility data under known conditions of pressure and temperature. The curves represent, therefore, equilibrium conditions which can never quite be realized in a large scale unit. In practice, however, the results approach sufficiently close to these curves to justify their use.

Certain assumptions have been made in order to simplify the presentation of these data. It has been assumed that the water to be degasified is saturated with oxygen and nitrogen gases when entering the deaerator since this condition imposes the greatest load on the equipment and is a limiting factor in the design of the apparatus. It has been assumed, also, that the temperature of the water is not changed during degasification. Actually, the temperature would decrease due to evaporation of the water resulting from evacuation of gases. It has been found that when operating deaerators under normal outdoor conditions, the temperature of the water will be reduced from three to five degrees. Obviously, the magnitude of the correction for this factor will depend upon the degree of saturation of the influent water with dissolved gases, the temperature of the fluid and the vacuum maintained.

Other basic assumptions which must be made when designing such equipment and evaluating its potential efficiency are:

1. The flow rate of the liquid must be maintained sufficiently low in terms of gallons of water per square foot of cross section area to prevent flooding of the packing.
2. The depth of the packing must be such as to provide enough time for equilibrium to be reached or closely approximated.
3. The packing should be properly spaced to effect good distribution and so designed to prevent channeling.
4. Pipe lines of adequate size to remove the vapors with a minimum of pressure drop must be provided.

These curves are not intended to serve completely as a basis for design but are suitable to indicate performance and to serve as a guide to show the range of variables to be met in practice. Their proper use should aid in controlling the operation and minimizing the number of control tests necessary to secure best operation. They also serve to define to the designer the limiting conditions which the equipment must meet for any particular installation.

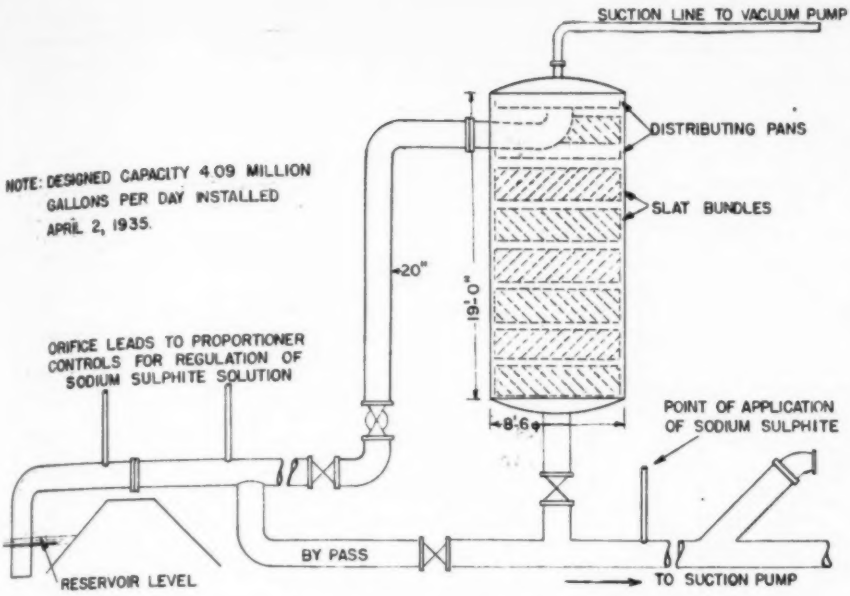
SUCTION LINE TO VACUUM PUMP
DISTRIBUTING PANS
SLAT BUNDLES
NOTE: DESIGNED CAPACITY 4.09 MILLION GALLONS PER DAY INSTALLED APRIL 2, 1935.
20"
19'-0"
8'-6"
ORIFICE LEADS TO PROPORTIONER CONTROLS FOR REGULATION OF SODIUM SULPHITE SOLUTION
POINT OF APPLICATION OF SODIUM SULPHITE
BY PASS
RESERVOIR LEVEL
TO SUCTION PUMP

Fig. 2. Design for Deaerating Tank and Slat Packed Tower Construction for Grande Ecaille Mine of Freeport Sulphur Co.

In Fig. 4 is shown the relationship between the absolute pressure that must be maintained in a deaerator at 68° F. to obtain various desired residuals of oxygen in the degasified effluent. Normally the pressure in the deaerator will be due to three main variables as indicated, the pressure exerted by the oxygen, the nitrogen and the water vapor pressure. Their summation is the absolute pressure in the unit and if deducted from the atmospheric pressure represents the vacuum in the deaerator. In certain instances carbon dioxide, hydrogen sulphide and other gases will also make up a portion of the total pressure in the unit. The curves in Fig. 5 show the vacuum required for deaeration at various temperatures as a function of residual oxygen.

The curves shown in Figs. 4 and 5 are independent of the water flow as long as the deaerator has sufficient capacity to perform its required functions.

The data shown graphically in Fig. 6 have been calculated on the basis of a flow of 1000 gpm. and show the relationship between the residual oxygen in the degasified effluent and the volume of gas which must be removed under the vacuum conditions which exist in the deaerator. As for the previous curves, the data have been calculated for instances in which the water enters the deaerator at various temperatures.

The data in Fig. 6 represent theoretically calculated curves for the saturated conditions assumed. Where vacuum pumps are used they should be selected to allow for the decrease in efficiency occurring due to maintenance of the low absolute pressure on the suction side of the pumps.

Applicability of Vacuum Deaeration

The effectiveness of removing dissolved oxygen from water in contact with steel is shown for comparative purposes in Fig. 7. The loss of weight of steel tubing in terms of milligrams has been plotted for an aerated and deoxygenated water. It will be seen that in the oxygen free water the rate is slow and retarded with time, whereas in an aerated supply corrosion is accelerated continuously.

Fig. 8 shows the effect of deaerating the water supply at Port Sulphur. As stated previously, the carrying capacity of this line decreased from 4 to 3.2 mgd. over a period of a few months. Following cleaning of the pipe line mechanically, and after the deaerator was placed in operation, the capacity of the line was restored to 3.8 mgd. The total decrease in capacity experienced in the next eight months amounted to only 36,000 gpd. Subsequent losses during the intervening years have shown that the corrosion of the line, if occurring, is only at a moderate rate and it is probable that the treatment will provide protection of the metal for many years.

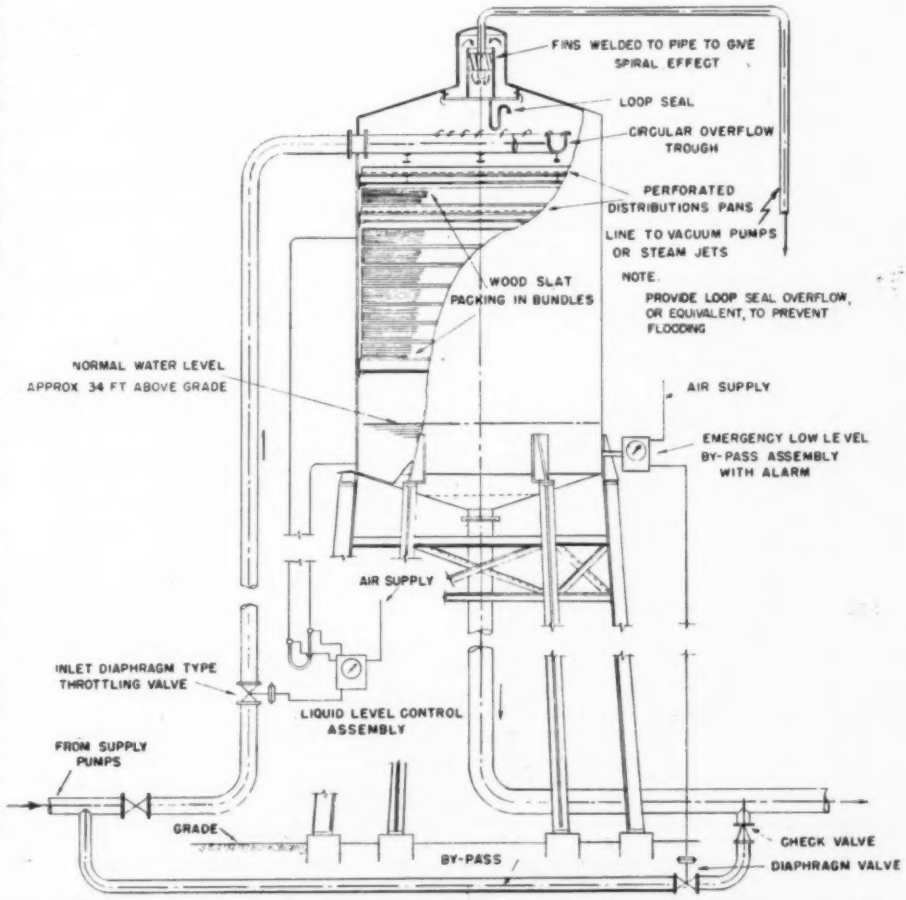

Fig. 3. General Arrangement of Piping and Controls of a Single Stage Cold Water Vacuum Deaerator

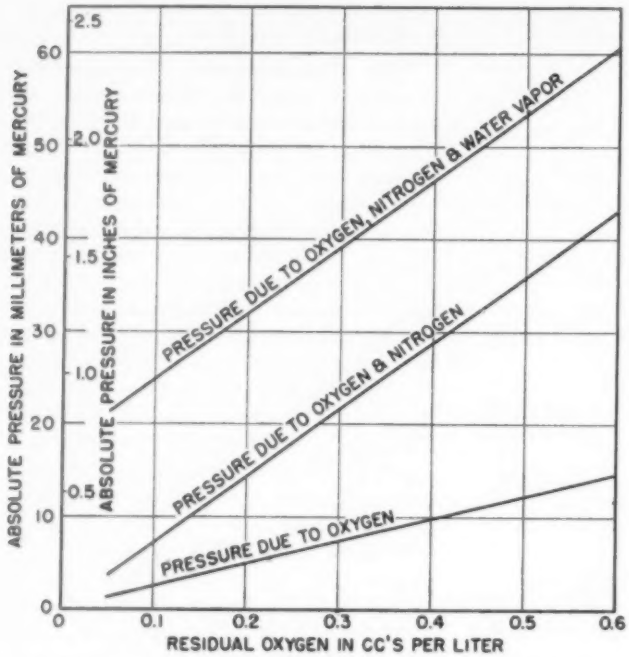
ABSOLUTE PRESSURE IN MILLIMETERS OF MERCURY
ABSOLUTE PRESSURE IN INCHES OF MERCURY
PRESSURE DUE TO OXYGEN, NITROGEN & WATER VAPOR
PRESSURE DUE TO OXYGEN & NITROGEN
PRESSURE DUE TO OXYGEN
RESIDUAL OXYGEN IN CC'S PER LITER

Fig. 4. Absolute Pressure Required for Deaeration as a Function of Residual Oxygen. Temp. 68° F.

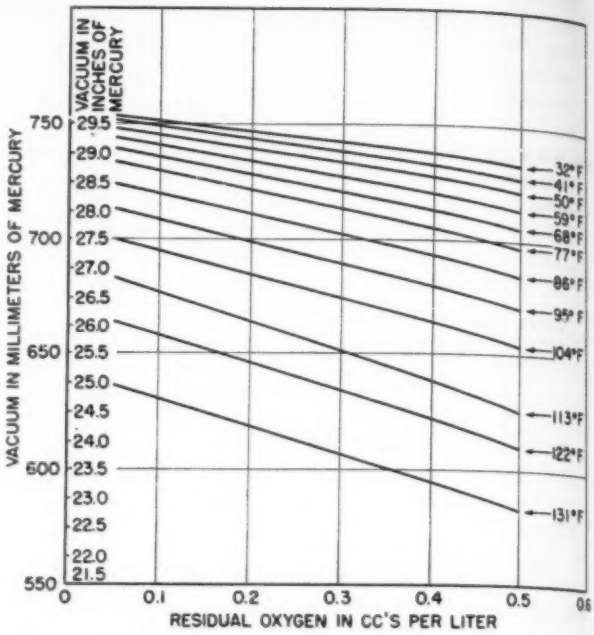

Fig. 5. Vacuum Required for Deaeration at Various Temperatures as a Function of Residual Oxygen

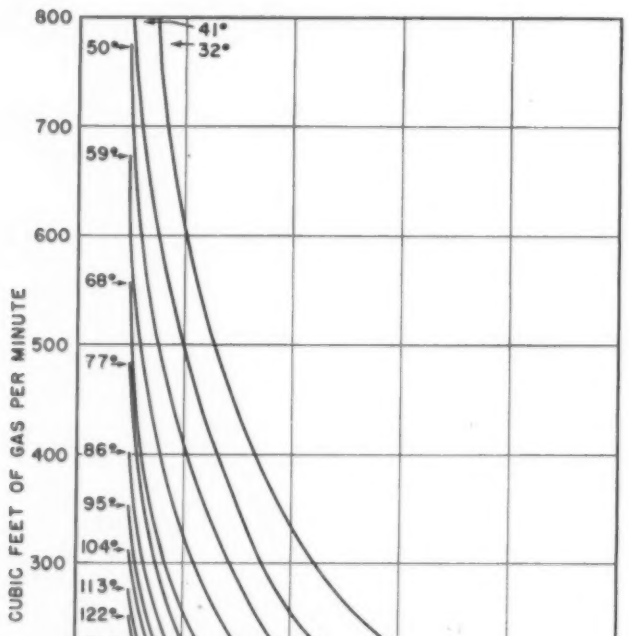

Fig. 6. Volume of Saturated Air to Be Removed Under Vacuum at Various Temperatures and a Water Flow of 1000 gpm. as a Function of Residual Oxygen

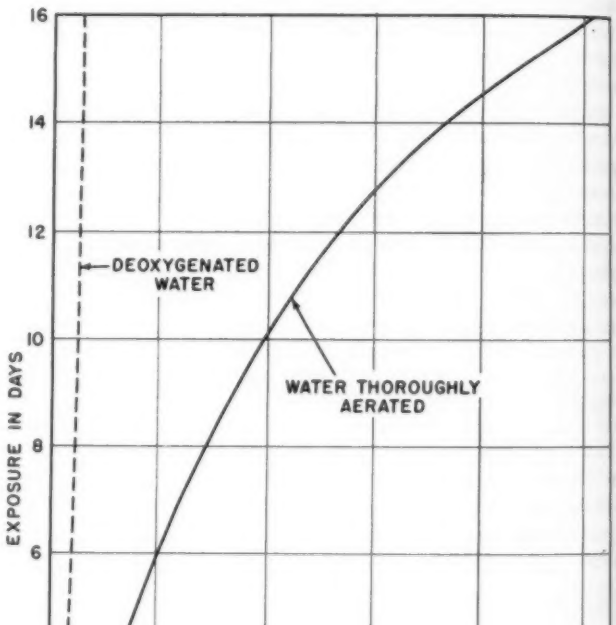

Fig. 7. Chart Showing Effect of Oxygen on the Corrosion of Steel Tubing

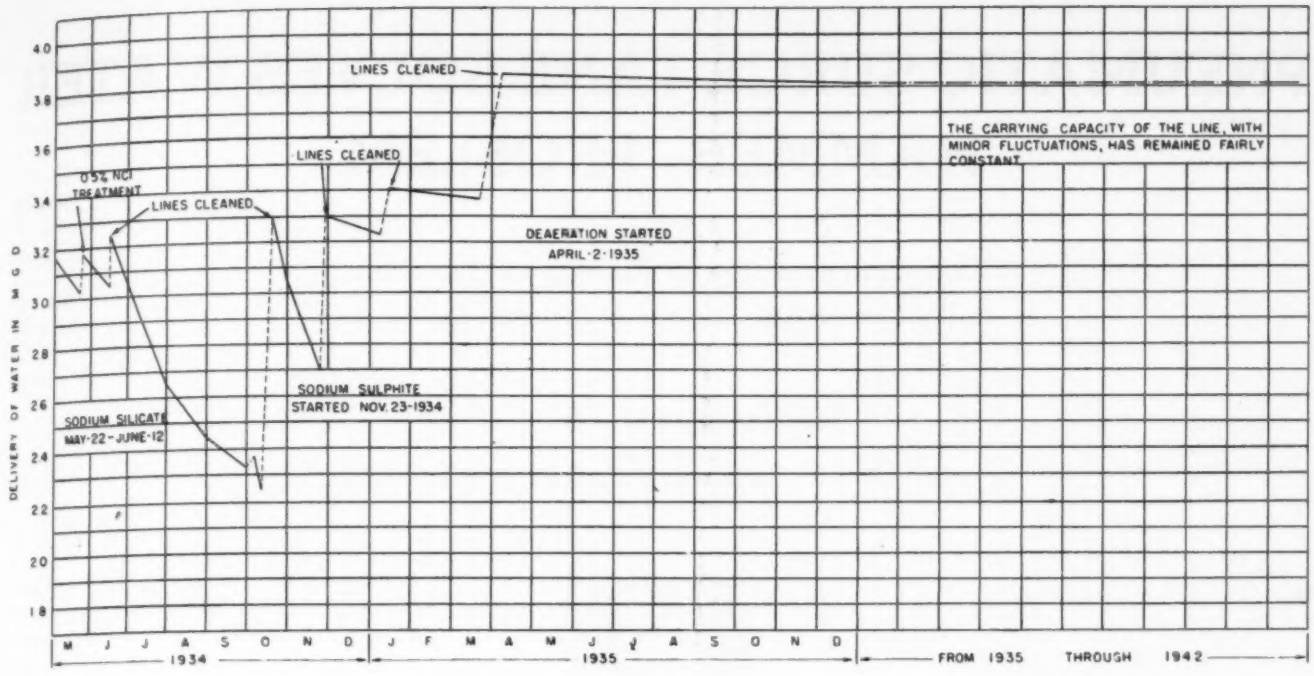

Fig. 8. Chart Showing Reduction in Carrying Capacity and Subsequent Recovery in Uncoated 14-in. Welded Steel Pipe After Mechanical Cleaning and Deaeration of Water

Selection of Type of System

The decision to install a single or multiple[6] stage deaerator should be governed to a large extent by the economics involved. The original cost of the equipment must be balanced against the daily operating cost, the cost of using partial chemical deaeration to complete the treatment and the reduction in losses that may be effected by the selection of the most suitable design. Labor and location near a source of power are other factors which affect the design of the apparatus.

There are a number of advantages secured from a multiple stage vacuum deaerator. The maintenance of a difference in pressure between stages reduces the expanded volume of gas that must be removed by the vacuum pumps, effects a net saving in the original pump cost and the daily operating charges. Further, such a design permits removal of the dissolved gas in smaller increments, the sum of which is appreciably less than if the gas were removed in one stage. Practically, adoption of multiple stage deaeration permits the economical maintenance of a lower amount of residual gas in the deaerated effluent.

In general, it may be said that single stage deaeration may prove to be the most economical design for most installations. This, however, can only be determined by a thorough examination of the problem and local conditions.

Secondary Chemical Treatment Following Vacuum Deaeration

Since the cost of the original investment and operating charges increases rapidly as a higher vacuum is maintained, designers have sometimes limited the operation of the deaerating units by controlling the vacuum within the range of 25 to 28 inches of mercury. If still further reduction of the residual oxygen in the deaerated effluent is required it can be effected by the addition of sodium sulfite or other deoxygenating reagents. Operators have resorted to such treatment in several instances in preference to the installation and operation of the more costly mechanical design. The results obtained have been successful in further reducing the active corrosion due to the dissolved oxygen.

Cost of Installation and Operation

Investment and operating charges have varied widely, depending upon the completeness of the design, the local conditions encountered, the capacity of the units and other factors which influence the structural requirements and power costs. In general, however, the purchase cost of equipment including the complete deaerator unit, vacuum pumps or ejectors and necessary control accessories has been approximately $10,000.00 for a single stage plant having a capacity of 1000 gpm. For each additional 1000 gpm. capacity up to a total of 5000 the purchase cost of the equipment has increased about $3500.00. In the case of extremely small installations the cost on the basis of a flow of 1000 gpm. has been two or three times that of the larger units.

Multiple stage units are obviously more costly to install; the justification for such design depends upon the value of the resulting gas removal efficiencies, higher than can be effected by reasonable power consumption to produce a high vacuum by single stage evacuation. If steam is readily available, the use of steam jet ejectors generally effects a saving in the initial installation cost. The selection of evacuating equipment will be found to depend on the balance that can be accomplished between initial cost, daily operating cost and the ease of operating ejectors as compared to vacuum pumps.

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2. Longley, Col. Francis F., The Coolgardie Pipe Line in Australia and Measures Taken to Correct Corrosion, *J. New England Water Works Association*, 39, 42 (1925).
3. McDermet, J. R., Engineering Assistant to President, Elliott Company, Private Communication to the Author.
4. Speller, Dr. F. N., Private Communication, 1934.
5. Powell, Sheppard T., and Burns, Homer S., Vacuum Deaeration Combats Cold-Water Corrosion, Chemical and Metallurgical Engineering, 43, April, 1936.
6. Powell, J. A., and Powell, Sheppard T., Patent 2,080,151.

PNEUMATIC SURGE TANK SOLVES WATER HAMMER PROBLEM

Experience at Bath, Maine, in Economically Correcting a Serious Surge Problem

By MAURICE A. LIBBY
Superintendent
BATH WATER DISTRICT
BATH, MAINE

SHORTLY before the entrance of the United States into World War II, the Bath Iron Works Corporation, a builder of destroyers for the U. S. Navy, erected a plate fabricating plant near the Thompson's Brook Pumping Station of the Bath (Me.) Water District.

The layout of the Bath water system included a main supply at Nequasset Lake about three miles east of the Kennebec River, a pipe line across the river to the city of Bath, thence about a mile to a standpipe on Rocky Hill west of the city. About two miles further west was Thompson's Brook with an auxiliary pumping station which was used only as an emergency supply.

A 12-in. cast iron pipe connected the Thompson's Brook Station and the Rocky Hill standpipe.

The Author

The fabricating plant was thus located on what amounted to a dead ended main, and being a large user of water, which was drawn from the 12-in. line through an 8-in. connection and several quick-acting valves, created a bad waterhammer condition, with pressures fluctuating almost constantly during working hours from 70 psi. to 115 psi., as indicated by chart No. 1.

Pneumatic Tank Installed

In June, 1942, a surge tank was installed in the pumping station, consisting of a galvanized steel tank, 3-8 in. thick, 24 in. in diameter and 12 feet high. A boiler gauge glass was mounted so that its middle point coincided with the quarter-full point of the tank.

This tank was connected through 6 in. flanged pipe to the discharge manifold of the pumping station and a 6 in. swing check valve was installed just ahead of the tank.

Fig. 1. Interior of Station Showing Surge Tank

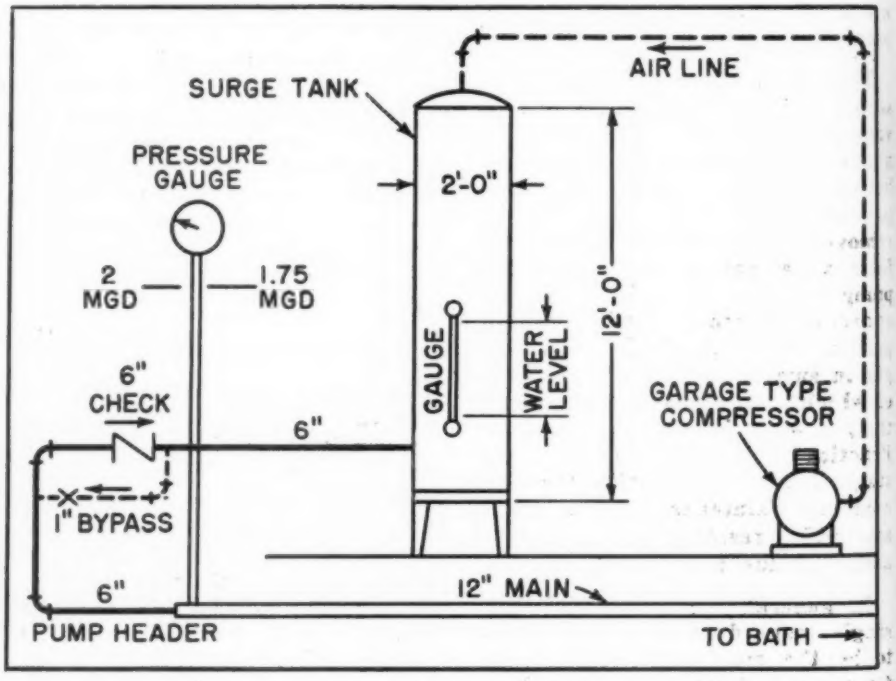


Fig. 2. Sketch of Pneumatic Surge Tank Installation

Mr. Libby has supplied this account of Bath's successful installation of the simple but highly effective and inexpensive pneumatic surge suppression air chamber, only after some insistence on our part of the value of Bath's experience to our readers who may not have profited from the Bennett article as has Bath.

Mr. Libby contended that he had done nothing new, having merely adhered to Mr. Bennett's recommendations in proportioning the volume of air chamber to the volume of water column in the main served by it. This very fact and the wholly satisfactory results attained are the two points of this article.

Aside from having accomplished the end sought, it is of considerable interest to point out that this installation brought about the cessation of a series of joint leaks which had already cost the Bath Water District several thousand dollars to repair. And, to Mr. Libby and his repair crew, the cost had been many hours of lost sleep and worry concerning the possible temporary failure of water service, so essential to an ultra important war industry.

This check is set so that water can flow into the tank and be prevented from flowing out, except through a 1 in. bypass around the check valve —(see sketch).

The water level in the surge tank is maintained at the quarter point by means of a garage type air compressor operated manually about once a week. This unit was obtained locally as a used compressor.

The installation has been completely successful in eliminating water hammer in this system as shown by comparing chart No. 1 and chart No. 2. The fluctuation in pressure is practically negligible, as will be seen.

An Economical Solution

The cost of the installation was approximately $235 to the Bath Water District. This cost covered compressor, labor and all fittings and materials other than the steel surge tank which was fabricated and supplied by the Bath Iron Works Corporation.

The design of the pneumatic surge tank was based on ratios of air chamber capacity to main capacity as recommended in the very valuable article "Water Hammer Correctives" by Richard Bennett, City Engineer of Phoenix, Ariz., which appears in the 1944 Reference and Data Number of *Water Works and Sewerage.*

(Ed. Note:—For the benefit of our newer readers we shall again reprint Mr. Bennett's comprehensive article, above referred to, in our forthcoming 1946 Ref. and Data Number which will this year be the April issue. This article describes and discusses a variety of measures and equipment for correcting surge and water hammer problems. It is an eminently practical and highly useful contribution to the water works practice literature.—L.H.E.)

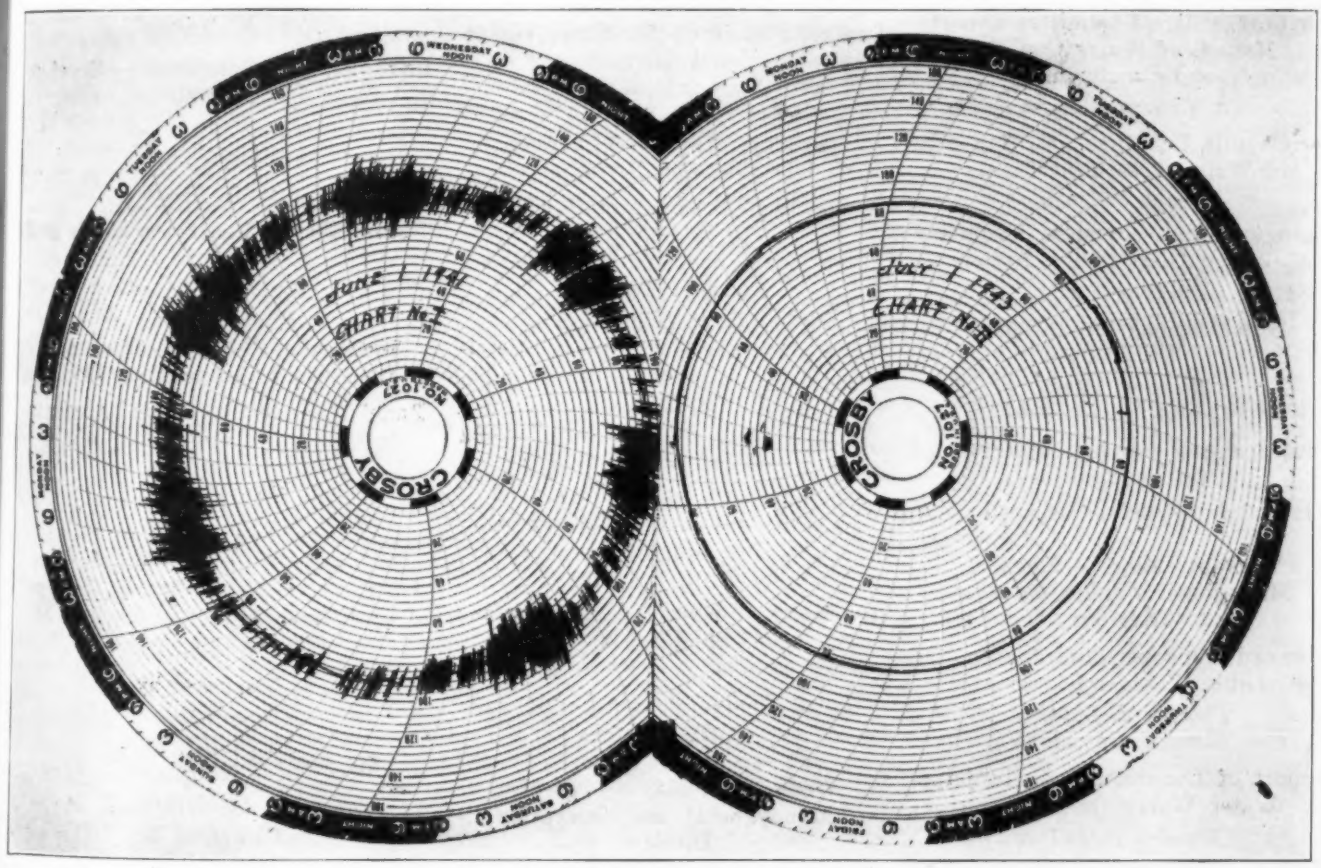


Chart 1—Pressure Record Before Installing Pneumatic Surge Tank

Chart 2—Pressure Record After Placing Surge Tank in Service

AWWA PROGRAM FOR ST. LOUIS CONVENTION

Features Corrosion Control; Labor-Management Relations; Closes with a Look at "What's Ahead for Water Works"

THE American Water Works Association has released the preliminary technical program developed for the St. Louis Convention May 6-10. Observations point to an all-time record for attendance at the 1946 Convention since already more than 1,000 room reservations have been made and requests for hotel accommodations continue to pour in at an unprecedented rate.

THE PROGRAM

Monday, May 6—Afternoon

A Public Relations Program for AWWA

An Open Conference

(In which the Executive Committee wishes to hear the voice of the membership on this important matter in conjunction with its consideration of the report of the Public Relations Survey Committee.)

Monday, May 6—Afternoon

Purification Div. Committee Reports

Manual of Water Quality and Treatment

A. Clinton Decker

Permissible Loadings and Capacity of Water Treatment Plants

Douglas Feben

Biological and Chemical Problems of Water Distribution Systems

Marsden Smith

Specifications for Filtering Materials

Richard Hazen
Thomas M. Riddick

Specifications for and Methods of Testing Zeolites

Daniel Davis

Tuesday, May 7—Morning Management and Operation Division

Planned Improvements for the St. Louis Water Department

Thomas J. Skinker
Elton E. Easterday

Report of Committee on Municipal Water Works Organization

Wendell R. LaDue

Water Department Reports—Why Prepared? Who Reads Them?

M. P. Hatcher

Meter Cephalalgia

S. F. Newkirk

A Scheduled Maintenance Program for Water Works

W. Victor Weir & H. O. Hartung

Discussed by

Paul Weir

Tuesday, May 7—Afternoon Management and Operation Division

Flow Coefficients and Leakage Tests on Concrete Pipe Lines

J. L. Irwin

Characteristic Deficiencies of Water Distribution Systems

R. G. Kincaid; R. E. McDonnell

Comparison of Existing Formulas for Pipe Flow

Julian Hinds

Procedure for Flow Tests of Pipe Lines

W. W. Wyckoff

Design Standards for Steel Water Pipe

Russell Barnard

Tuesday, May 7—Afternoon Purification Division

Symposium on Domestic Hot Water Tanks

From the Viewpoint of a Water Treatment Operator

C. P. Hoover

From the Viewpoint of a Metallurgist

J. M. Bialoski

Some German Methods of Heating Water for Household Use

Dr. H. L. Anthony

Corrosion Control—Theory vs. Practice

S. T. Powell

Corrosion Control—A Comparison of Methods

B. A. Poole

Enemy Water Supply Equipment

C. W. Karstens

Wednesday, May 8—Morning Management and Operation Division

Cooperative Health and Sanitation in the Americas

Col. H. B. Gotaas

Sanitary Corps in World War II

Col. W. A. Hardenbergh

The Missouri River Development Program

Maj. Gen. L. A. Pick

Water Supply in Germany—Some Observations

Arthur Gorman

Wednesday, May 8—Afternoon Management and Operation Division

"WATERSHED CONTROL"

General Outline—Scope of Activities and Program of the Committee

Earnest Boyce

Introductory Comments—Influences of Forestation on Reservoir Watersheds

Edward E. Minor

Influences of Forestation on Reservoir Watersheds

E. N. Munns

Introductory Comments — Erosion Control

John S. Longwell

Erosion Control

Carl B. Brown

Public Use of Reservoir Lands and Waters

Lewis S. Finch

Wednesday, May 8—Afternoon Finance and Accounting Division

Panel Discussion—Joint Administration and Collection of Water and Sewer Accounts

L. N. Thompson
H. F. Smith
A. E. Berry
W. F. Tempest

Meter Rate Structures

G. B. Schunke

Discussed by

Charles Capen
M. F. Hoffman

Stop Those Nuisance Charges

E. E. Norman

Discussed by

J. W. Pray
Roger Esty
C. M. Roos

Thursday, May 9—Morning
General Session

Chemical Soil Solidification
Martin Reidel

Foundation Treatment
L. A. Schmidt, Jr.

Leak Locators
G. R. Fisher

Utilization of Our Rivers in the Public Interest

E. B. Black
W. W. Horner
Abel Wolman

Thursday, May 9—Morning

Panel Discussion—Useful Life of Water Wells

J. C. Harding
D. A. Erickson
Angus Henderson
A. T. Luce J. B. Mills

Purchase and Maintenance of Deep Well Turbine Pumps

L. J. Alexander
Discussed by
T. E. Larson

Thursday, May 9—Afternoon
Joint Session M. & O. and F. & A. Divisions

"PERSONNEL RELATIONS"

"How Do You Get Along With Your Employees?"

Introduction—*P. B. Niles*
Employee Training—*S. C. Casteel*
Supervisory Training—*H. W. Lundin*

Employee Benefits—Pension and Retirement Systems

Dale Maffit

Union Relations to Municipally Operated Departments
W. R. LaDue

Union Relations to Privately Owned Plants

Van Horn Ely

Thursday, May 9—Afternoon
Water Purification Division

Experience in Remote Recording of Residual Chlorine in Water
J. R. Baylis, H. H. Gerstein & K. E. Damann

Observations as to Performance of Water Sedimentation Basins
J. D. Walker

Iron Salts as Coagulants
H. C. Schmitt
N. A. Thomas
J. E. Kerslake

Water and Its Treatment in Florida (A Motion Picture)
C. F. Wertz

Friday, May 10—Morning
General Session

"WHAT'S AHEAD FOR WATER WORKS?"

The Federal Housing Program
Author to be selected

New Equipment for Water Works
S. B. Morris; L. L. Camy

Price Levels—Water Rates
L. R. Howson

Problems and Program for the Water Works Manufacturer
Col. W. F. Rockwell

Train Transportation to the St. Louis Conference, AWWA

May 6th to 10th, 1946

The Transportation Committee is once more active and is attempting to provide the best possible train and Pullman accommodations for those desiring to attend the St. Louis Conference.

Train schedules have been selected by the Committee in order to provide for transportation to St. Louis from various areas of the country. These areas involve the Northeast, Southeast, Southwest, Far West, and Chicago.

Many of the railroads have expressed willingness to cooperate in every way possible even to the extent, if necessary, of providing extra cars on regularly scheduled trains for accommodation of the members of the AWWA. In order for the Transportation Committee to take advantage of such opportunities, it is very desirable that the Committee know as far in advance as possible just what accommodations will be required. Therefore, it is requested that all those desiring train accommodations to St. Louis should indicate their desires to the member of the Committee in their area. Complete information should be furnished to the Transportation Committee in requesting reservations. Such information should include the point of departure; date and time of leaving; type of Pullman accommodation desired; names of persons using the accommodations; and whether one-way or round trip rail tickets are desired. It is essential that reservations be made not only for the trip to St. Louis but also for the return trip.

Insofar as possible, accommodations will be assigned in the order in which requests are received. It may be possible that the specific type of accommodation requested will not be available, but the Committee will do everything it can to furnish the best possible substitute.

On all rail and Pullman fares a 15 per cent federal transportation tax will be charged on each individual item unless an exemption certificate is filled out on Form 731, Treasury Dept., Internal Revenue Service, copies of which are obtainable from the various offices of the U. S. Internal Revenue Dept. Exemption certificates must be furnished for each item. For example, when purchasing a round trip ticket and Pullman accommodations to and from St. Louis, three certificates must be supplied. Any municipal, county, state or federal employee may fill out Form 731, provided that travel is recognized as official business, and also provided that the official nature of the travel is, or will later be, evidenced by reimbursement of the amount paid for transportation.

Persons who desire further information or reservations should contact one of the members of the Transportation Committee given below.

J. R. Barker
Neptune Meter Co.
320 Market St.
San Francisco 11, Calif.

Cyrus R. Bird
The Pitometer Co.
205 W. Wacker Drive
Chicago 6, Ill.

James R. Brown
National Water Main Cleaning Co.
205 W. Wacker Drive
Chicago 6, Ill.

Hugh S. Dewey, Mgr.
Western New York Meter Co.
11 Niagara St.
Buffalo 2, N. Y.

C. N. Isaacson
U. S. Pipe & Foundry Co.
912 Pershing Square Bldg.
Los Angeles, Calif.

H. M. Olson
Ohio Salt Co.
171 Longue Vue Drive
Mt. Lebanon
Pittsburgh 16, Pa.

O. J. Ripple
Supt. of Filtration
R. F. D. No. 2
Littleton, Colo.

Ralph R. Silver
Silver & Douce Co., Inc.
310 Protective Life Bldg.
Birmingham, Ala.

Egmont S. Smith
Neptune Meter Co.
2014 Commerce St.
Dallas 1, Tex.

E. A. Sigworth
Suite 1333
230 Park Ave.
New York 17, N. Y.

MAINE WATER UTILITIES ASS'N MEETING BACK TO PRE-WAR FORM

Chairmen

J. W. Randlett
Supt.
Richmond, Me.
(Vice-Pres. MUWA)

J. A. Jackson
Asst. Treas.
Portland
Water District

THE annual Portland meeting of the Maine Water Utilities Association was held in the very handsome and adequate Service building of the Portland Water District Feb. 12th and 13th.

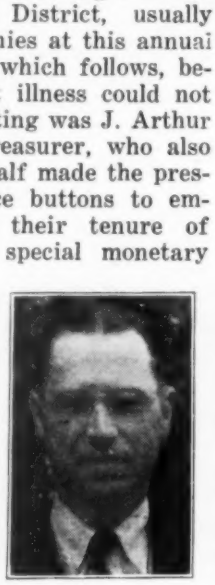
Resumed again were the manufacturers' exhibits discontinued during the war period. In addition there were demonstrations of the use of equipment such as the gasoline motor driven pick, revealing its value on frozen ground, and a main cleaning demonstration involving hard to clean 4 inch pipe with the use of a "scouring pill" (a ball encased in chain jacket) propelled through the pipe by water pressure. On a lightly tuberculated run of 4 inch pipe it did a good job.

Milton Thorne
Supt., Portland
Water District

Chowder and Doughnuts

On the evening of the 12th the employees' organization of the Portland Water District known as the "Water Meeters" served another of those famed suppers, featuring what this writer believes is the "world's best" Maine style clam chowder and doughnuts of which there are no whicher.

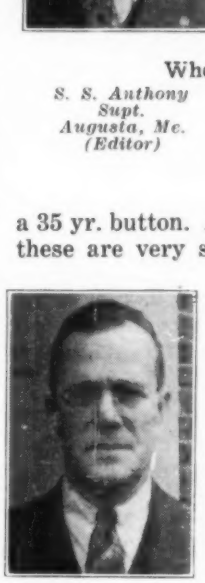
Fred J. Reny, Genl. Mgr. of the Portland Water District, usually master of ceremonies at this annual supper and show which follows, because of a recent illness could not officiate. Substituting was J. Arthur Jackson, Ass't Treasurer, who also in Mr. Reny's behalf made the presentation of service buttons to employees denoting their tenure of service and also special monetary awards to employees who had returned from service with the armed forces. Oldest employee receiving a new service button was Chesley Ward, Supt. of Meters, who exchanged his 35 yr. button for a gold 40 yr. button. Others with 40 years of service include Mr. Jackson himself and Milton Thorne, General Supt. Harry Fuller, Chief Engr., has for a couple of years been wearing a 35 yr. button. And, let it be known, these are very swanky buttons, too.



Programmers

C. R. Pearson
Whitman & Howard
Engrs.
Boston

L. K. Parker
Supt., Auburn
Water Distr.



C. R. Moore
Ass't Engr.
Portland
Water District

Wheelhorses

S. S. Anthony
Supt.
Augusta, Me.
(Editor)

Harry U. Fuller
Chief Engineer
Portland
Water District

TECHNICAL PROGRAM

Following the supper and the presentation of awards a Hill-Billy Orchestra did a good job of aiding the digestion.

And then to the business of the evening — the presentation of papers.

"Experiences in Lowering a 30 Inch Water Main" were recounted by Milton Thorne, General Superintendent of the Portland Water District. He was aided by lantern slides and a model of the arrangement of 2 inch boards and wedges which were gradually removed from beneath the main in lowering it onto new piers some feet lower where the 30 inch main originally crossed a ravine on a fill. The fill

"Reg." Hayes
Sales Mgr.
Hydraulic Devel. Co.
New York
and
Arthur Faneuf
Asst. Supt.
Concord, N. H.

Bob Fergusson
Hersey Meters
Bill McGarry
Neptune Meters
Dick Sweeney
U. S. Pipe

A Camera Duel
("Sid Anthony was quick on the draw, but not quick enough — so here's the result)

Alan McAlary, Supt.
Rockland Water Co
Rockland, Me.
(center)
Ed. McDowell, Supt.
Biddeford Water Co.
(right)
And who?

R. K. Newcomb, Supt.
Skowhegan Water Co.
and
L. K. Parker, Supt.
Auburn Water Dist.

"Al" W. Reed Supt. Water Dept. Bangor, Me. | *Howard Baily Consulting Engr. Boston* | *Maurice Libby Supt., Bath, Me., Water Dist.* | *De Masse Potter Portland Water District (Ex-Seabee Lieut.)* | *"Nat" Grover Water Commissioner Boothbay Harbor* | *J. M. Caird Consulting Chemist Troy, N. Y.* | *Percy R. Sanders Supt., Water Dept. Concord, N. H.*

washed out to leave this heavy main suspended in thin air. Remarkable was the fact that none of the lead joints sprang a leak. At the same time that the main was lowered it was pushed down stream with a 10 ton jack.

"The New Shore Acres Standpipe," as described by Chas. R. Moore, Assistant Engineer, Portland Water District, is 30 ft. in diameter, 80 ft. high and holds 422,000 gal. The standpipe was fabricated and installed by Pittsburgh-Des Moines Steel Co. for $13,740, the painting being done by M. B. Main of New Jersey for $994.00. The total cost, including land and Ross Regulator valves, was $22,312.95 for this 422,000 gal. storage and pressure and flow amplification unit.

Mr. Moore then presented an analysis in which the cost of laying additional parallel mains to reach the same point of increased pressures and delivery to the section served was compared with the standpipe cost. The duplicate main cost would have been $85,330 in this instance, not to lose sight of the advantage of having the stored water to supply the area during periods of shut down for repairing the troublesome 16-in. submarine main feeding the Shore Acres area.

The session closed with the showing of movies brought back by De Masse Potter, until recently Lieutenant in Uncle Sam's competent Sea Bees.

Then, in the words which appeared on the printed program, "After this, those who have been so fortunate as to find hotel accommodations will adjourn to their rooms. Others will be allowed to sleep in their cars for which space has been arranged in the Water District Service Building and Garage."

Chas. L. Lombard Retiring Supt. Yarmouth, Me. and Myron L. Eastabrook New Supt. Yarmouth, Me.

Frank C. Harmstad Sales Mgr. R. D. Wood Co. Harry Fuller Chief Engr., P.W.D. "Ray" Ford R. D. Wood Co.

Chas. M. Hobbs Supt., Farmington, Me. and Frank Wells A. P. Smith Co. East Orange, N. J.

PROGRAM OF THE 13TH

The forenoon of the 13th was given over to inspection of exhibits, watching demonstrations and just old fashioned shop talk while whetting an appetite for lunch—dinner they call it in Maine, and it was.

Following the noon dinner more papers were presented while in the absence of President Dave Moulton in Florida, Vice President Joe Randlett of Richmond, Maine, presided.

The member who had traveled farthest to the meeting (therefore winner of the free dinner) was G. E. Gardner of Patten, Maine.

"Water Intakes of Auburn" were described by L. K. Parker, Superintendent Auburn Water District. Submerged under 9 ft. of water out 200 ft. from shore in Lake Auburn, the intake consists of a screen box constructed of white oak with top bars spaced 2 in. apart and ¾ in. slats forming the 4 sides and bottom which rests on a rock crib. This screen box, 5 ft., 10 in. long by 3 ft., 4 in. wide and of the same depth feeds a 24 in. pipe delivering to a suction well at the pumping station. In the inlet of the suction well are four sets of screens of copper wire providing about a quarter inch mesh.

Mr. Parker told of serious ice troubles due to winds piling up broken ice at the intake screen box until hardly any water flowed to the pumping station. Solid slush ice filled the lake from surface down to bottom around the intake and 600 ft. out from the shore. Lewiston, with an intake near Auburn's, experienced the same diffi-

"Tom" Craven Warren Pipe Co. Boston and "Herb" Crowell Rensselaer Valve Co. Troy, N. Y.

Lunch Session (Part 1)

Main cleaning demonstration of 4-in. main cleaning with iron "pill," consisting of a ball enmeshed in a scouring chain.

Lunch Session (Part 2)

"Jo" Fitsimmons Kennedy Valve Co. Elmira, N. Y. and "Pat" Kelly The Leadite Co. Philadelphia

Secretary
Earl A. Tarr
Supt.
Winthrop, Me.
Water District

Discussor
Francis L. Hatch
Supt.
Kittery, Me.
Water District

culties and Mr. Parker advocates extension of the intake out further into the lake as a joint enterprise with Lewiston.

"A New Type of Eel Screen" was described by C. Rogers Pearson, who is a member of the staff of Whitman & Howard, Boston engineers, and substituting for Paul Howard at home sick.

These screens have been built into the pipe line from reservoir to Kittery, Maine, to check the passage of eels into the distribution system. Each of the two 12 in. mains has been divided into twin lines and basket type pressure strainers inserted in each of the four lines, making it possible to have two strainers in service at all times. The baskets have 3/16 in. circular holes providing openings three times pipe area. Ordinarily weekly cleanings are sufficient but when the pressure drop through a strainer reaches 2 pounds the unit is opened and basket removed for cleaning. These units are manufactured by Blackburn & Smith.

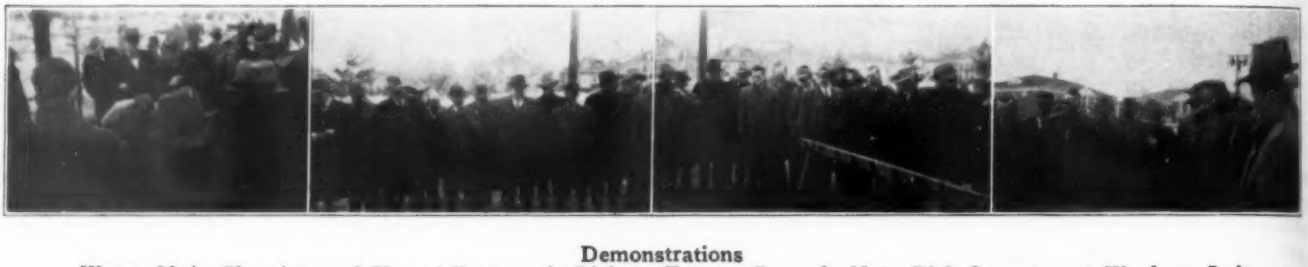
Francis L. Hatch, Superintendent at Kittery, told of their experiences with eel troubles. Actually he said that these critters, in addition to stopping water service lines by getting their heads caught in the corporation cocks, apparently could get through leaking pipe joints, because in the trench when pipes were dug up full grown eels had been dug up alongside.

Harry U. Fuller reported interesting experiences with intake screens which had to be made of fine mesh bronze wire lately because in recent years fish had seemingly been becoming smaller, whereas earlier fish troubles had not been experienced. The breed of fish about one-inch long and no thicker than a match stick, which had appeared lately, were found to be full grown at that small size.

A Free Dinner
G. E. Gardner
Supt.
Patten Water Co.
(Longest traveler to the meeting)

40 Year Man
Chesley L. Ward
Supt. of Meters
Portland
(Received PWD's gold 40-yr. button)

No one had had any experience with electrified fish screens to keep fish away from intakes, but **L. H. Enslow** told of a novel scheme employed to keep fish away from intakes with chlorine. By running the chlorine hose out to discharge in front of the intake, fish would not enter the zone where the chlorinated water exists in front of the intake inlet.



Demonstrations
Water Main Cleaning and Use of Pneumatic Pick on Frozen Ground. Note Pick Operator at Work on Left.

J. K. Marquis Passes

Had Been Spartanburg's Engineer-Chemist in Charge of Water Purification and Pumping, Since 1926

J. K. Marquis, Engineer-Chemist for the Spartanburg (S. C.) Water Works, died Jan. 28. A native of Knoxville, Tenn., and a graduate of the Univ. of Tenn., he had taught engineering at that institution. Mr. Marquis was employed by the city of Spartanburg in 1926 and has been actively identified with all water works improvements since that time.

A past president of the South Carolina Water and Sewage Works Association, Mr. Marquis had served several years as Chairman of the Certification Committee.

He was also a well known contributor to the pages of *"Out of the Spigot,"* the news-letter of the S. C. Water and Sewage Works Assn. and the S. C. State Board of Health. Mr. Marquis was 61 at the time of his death.

First Release on Surplus Property Offerings of Interest to the Sanitary Field

The first Surplus Property Listing of material in the Sanitation Supply Section, has just been released. In this Sanitation Series Release No. 1 are several centrifugal pumps, some deep well pumps, air compressors, and a large number of tractors. Inasmuch as release of these lists will often not correspond to publication dates of *Water & Sewage Works,* and since a stale list will prove of little value, it will not be our policy to print the releases. It is suggested that interested parties who wish prompt information on war surplus items as they become available should by all means get their names placed on the mailing list.

Elsewhere in this issue is a list of the eleven regional Surplus Property Offices, their addresses, and telephone numbers. It is suggested that water and sewage utilities contact those offices for further information on these offerings of surplus property and request the prompt mailing of listings as these become available. Such may be done direct or through the Surplus Property Division of the U.S. Public Health Service, Washington, D.C.

WATERFRONTS OF WORLD WAR II*

By WILLIAM W. HASSLER
Professor of Chemistry
OGONTZ COLLEGE
RYDAL, PA.

GENERAL McARTHUR'S triumphant return to Manila was marred by the destruction of fully half the once enchanting "Pearl of the Orient." Included in the miles of ruins was the Manila waterworks system. Fearful lest water-borne epidemics add to the plight of the liberated Filipinos, MacArthur immediately radioed for purifying equipment. By "return air," chlorinators were flown from this country to the Philippine capital.

This incident is one of many in World War II which illustrates the critical demand on all fronts for drinking water. Although the least secret of the weapons of this conflict, drinking water has played a vital role in phases which range from turning the tide of a battle to the "thirsting out" of conquered subjects.

Water Reverses a Battle

Probably the most notable instance in which water reversed the course of battle occurred at El Alamein. On a scorching July day in 1942, the famed Afrika Korps broke through the lines of the British Eighth Army defending the key City of Alexandria. Only a few thousand weary British infantrymen, together with fifty battle-scarred tanks, disputed the "Desert Fox" Rommel's advance. But the Tommies possessed one enormous advantage—they were adequately stocked with drinking water, whereas Rommel's extended and overtaxed supply lines were unable to furnish his troops with this necessity.

Three divisions of the Afrika Korps pierced this last defense and were headed for Alexandria, when their thirst-stricken fighters paused at a British pipeline and punctured it with bullet holes, producing fountains to assuage their burning thirst. A stream of guttural profanity doubtless issued from the 'Boches' lips when they discovered that the main was filled with salt water, which the British had used to test the pipe—fresh water being too precious for such a purpose. The agony produced by the salt water, gulped by many before realizing it, incapacitated the troops for further advance, whereupon eleven hundred rushed to the British lines where they surrendered their liberty for a drink of fresh water.

Major Peter Rainier, Water Supply Officer, the Royal Engineers

Licked the desert with his fresh water pipe lines; threw the thirst-crazed enemy into panic when only salt water was found in a captured line.

On chasing the Germans back to Tripoli, Montgomery's troops almost experienced the El Alamein episode in reverse. The retreating Germans blew up many of the wells or dosed the water with nauseating bone-oil distillates, thus rendering the water unfit to drink. This necessitated British water trucks bringing up the vital fluid from wells two or three hundred miles behind the front. During the last five or six days of the Tripoli campaign, the water ration per man for all purposes was only one quart. One veteran reported graphically: " . . . it was a pretty scummy and smelly army—with no water for bathing or shaving—that marched into Tripoli as conquerors."

When historians record the footprints inscribed by the British Eighth Army on the African sands, due credit should be given to Frederick J. Kisch, a Zionist, and Major Peter W. Rainier, a British mining engineer. During the back and forth tug of war campaigns, preceding the final drive which evicted the Axis forces from Africa, water was obtained principally from existing and newly-bored wells.

(Marine Corps Photo)

Well Hidden Under This Pepper Tree Is U. S. Marine's Water Company B

With mobile water purification units engineers accompanied U. S. Marines right into battle. Employing trees and camouflage nets these operations were well hidden—an important consideration.

*By mutual agreement, this article will appear also in the March, 1946, issue of *Taste and Odor Control Journal*, published by Industrial Chemical Sales Div. of the West Va. Pulp & Paper Co., with which the author was associated prior to his present position at Ogontz College.

(Army Air Force Photo)

"Water Packages" Dropped from Planes by Parachutes
(These "packages" are newer than those made up of metal cans earlier in the war as described in Mr. Hassler's article.—Ed.)

Shelling enemy wells and poisoning those abandoned became a common practice of desert warfare. Kisch, who lived in Palestine before the war, realized that success would be on the side of the biggest water supply as well as with the largest battalions. He remembered that in the last war Allenby's desert troops had been reduced to a scant ration of one pint of water a day. Therefore Kisch conceived the plan of piping water to Wavell's desert troops, and even went so far as to procure 100 miles of pipe from the oil companies of Iraq and Palestine. The one cog he lacked was an engineer to supervise the construction. In typical English fashion, a retired mining engineer, Peter Rainier, rose to the occasion.

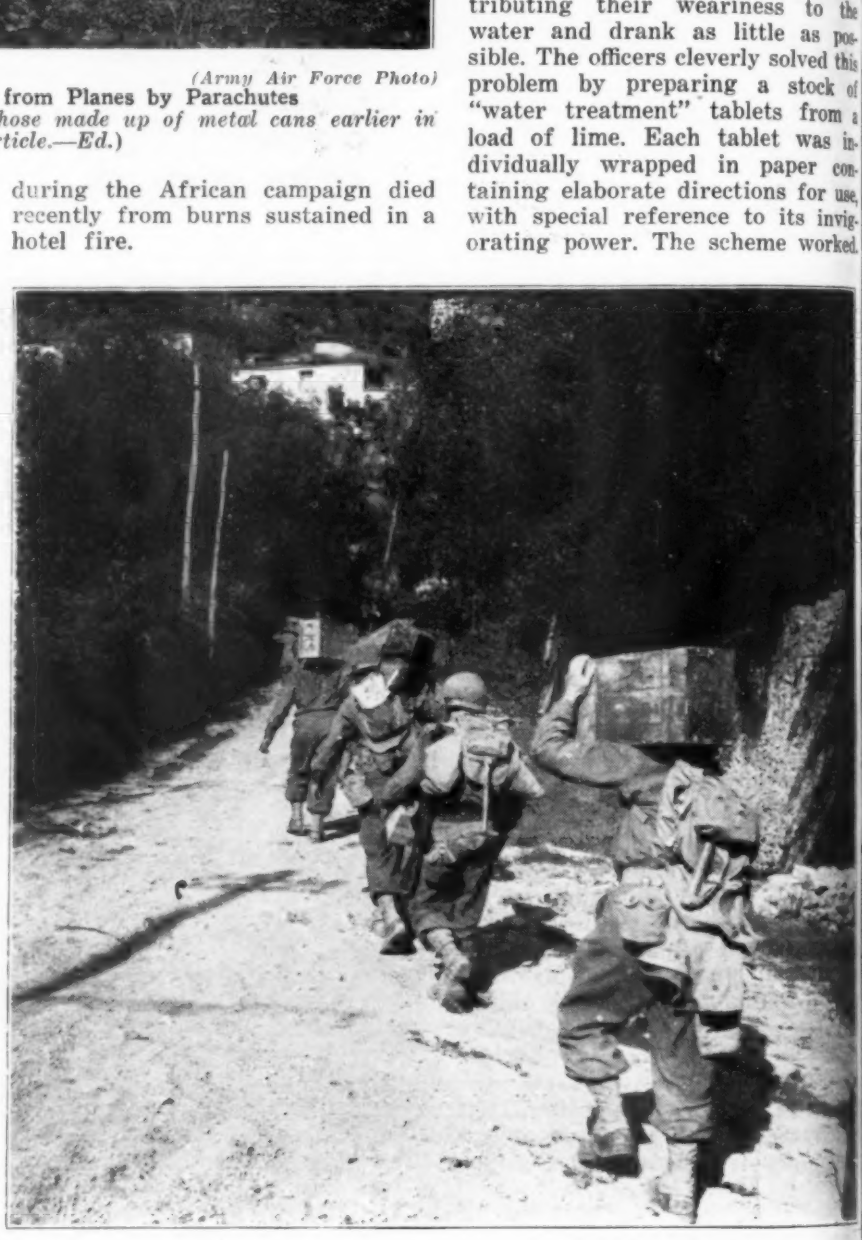
The outbreak of World War II found 50-year-old Rainier convalescing in Egypt. Eager to help, he volunteered his services to the engineers but was rejected because of age. Undiscouraged, he later falsified his age and was accepted by the Royal Engineers. When Rainier's brigadier learned of his pipe-laying experience, he assigned him to the task of pumping water from Alexandria to the oscillating front.

By means of a pipeline and fifty lush wells, Rainier kept every soldier of the Eighth Army supplied with a gallon of water during most of "Monty's" brilliant campaign which swept Rommel (now the "Desert Rat") from El Alamein to northern Tunisia. By a tragic irony of fate the man who supplied the British Eighth Army with water during the African campaign died recently from burns sustained in a hotel fire.

The Part of the "Water Diviner"

In connection with well-drilling, it is interesting to note that the British Army employed several water diviners in the Royal Engineers. Using a hazel twig as a divining rod, considerable success was reported in locating underground water.

When German efficiency was unable to equal English ingenuity in supplying desert troops with water, Goebbel's propaganda was employed to undo Major Rainier's work. Although all water supplied to the Eighth Army was clarified and chlorinated, a Nazi-inspired rumor spread throughout the British ranks that water from the newly-bored wells weakened one's constitution. Battle-fatigued veterans began attributing their weariness to the water and drank as little as possible. The officers cleverly solved this problem by preparing a stock of "water treatment" tablets from a load of lime. Each tablet was individually wrapped in paper containing elaborate directions for use, with special reference to its invigorating power. The scheme worked.



(Signal Corps Photo)

Troops Hauling Food and Precious Water to Their Fighting Buddies Operating from High Vantage Points in the Italian Campaign

From North Africa the Allies hopped to Sicily to gain a toe-hold on the Italian boot. Here the contrasting treatment of native populations by our troops and the Germans was strikingly illustrated. Notwithstanding the herculean task of supplying each division with 50,000 gallons of water a day, American engineers exerted every effort to avoid depriving the natives of their supplies. Water was pumped from irrigation ditches and newly sunk wells to supply our troops. On the other hand, the Germans baldly commandeered native wells for their own use.

In Italy the German commanders continued this same ruthless disregard of civilian needs. Before being evicted from Naples, German troops completely destroyed the water system. As a result, water was so scarce that in desperation the civilians dredged sewers to obtain their supplies.

As the allied armies approached Rome, General Alexander moved to forestall such sacking by appealing to the Romans to "prevent the destruction of your city . . . Guard for your own use all public-utility services such as water . . ." Fortunately, this admonition became unnecessary when both sides declared Rome an open city, Marshall Kesselring promising that "after evacuation of the town by German troops Rome shall be supplied with water and electricity from supply installations used so far, providing they are in possession of the Wehrmacht."

(Signal Corps Photo)

Setting Up a Raw Water Supply Pump
This unit is delivering to a well hidden field purification plant. Note use of trees to hide operations and such vital units as water supply equipment.

Water for the European Invasion

Plans for the invasion of Europe included elaborate arrangements to provide every GI with an adequate supply of safe water. The task was enormous. On D-Day alone, 90,000 parched sweating soldiers had to be provisioned with water; and this number was soon swelled manyfold.

During D-Day and until such time as inland supplies could be procured, our troops drank "canned" water supplied in five-gallon containers. In addition to the normal allotment ferried across the Channel, additional water cans were crammed into every nook and cranny unoccupied by other provisions in the holds of all supply ships. Each soldier was also issued chloramine tablets to disinfect whatever water he could find in case the treated supplies should be cut off.

General Eisenhower's decision to drop the 101st and 82nd American Airborne Divisions at the base of the Normandy peninsula on the dawn of D-Day, provided the first test of a novel water supply system. Paratroop units were supplied with "water bundles" consisting of eight two-gallon cans filled with water laid side to side in rows of four and two tiers high—the stack being held together by thick strips of wood. This framework was then padded and covered to cushion the impact of the fall when these precious packages were dropped from supply planes to paratroopers.

Once the inland supplies were seized, the Sanitary Corps assumed the duty of supplying water to the troops. First, the water was quickly analyzed for the presence of poisonous chemicals. If the water passed these tests, mobile water purification equipment was rushed to the so-called "waterpoint." Water was treated by conventional methods including coagulation, filtration, and chlorination. The purified water was stored in collapsible canvas tanks having a capacity of 3,000 gallons. From this "clearwell," water was pumped through a "gas station hose" into cans which were then hustled to the front. It is indeed a tribute to the Sanitary Corps that they not only supplied our troops adequately

(Signal Corps Photo)

A Water Purification Company Lands Right Behind the First Invasion Troops
In this instance sea water is being distilled right on a beachhead. Note 10,000-*gal. steel tank with supply pump near water edge on right. The still is in center. Pre-fabricated tank was rolled out from L.S.T. landing craft on left.*

with water, but that not a single case of typhoid or dysentery has been traced to Army water supplies.

In connection with the problem of supplying safe water, it is interesting to note the emphasis on palatability. During the last war medical observers with the British Army noticed that troops frequently rejected disinfected but foul-tasting water in favor of better tasting untreated supplies. Hence in this war an extensive campaign was waged to impress the troops that "GI water," though reeking of chlorine, was safe. When available, activated carbon was used to eliminate the nauseating chlorine taste. German supply officials faced with the same problem, issued their soldiers a lemon-flavored powder with which to mask the taste of their water.

The whirlwind advance of Eisenhower's forces through France following the breakthrough at St. Lo, severely stretched the water supply facilities. As usual, our water engineers performed the impossible, and were rewarded in part by not having to rehabilitate the Paris water system which the hastily retreating Boches did not have time to demolish. This water system, employing ozone for purification, was left intact with limited pumping power due to shortage of electricity.

Water Scarcity Used as Punishment

A less fortunate capital was Copenhagen, hotbed of Danish underground activities during the German occupation. After typically severe military measures failed to suppress widespread sabotage, the German authorities in desperation refused to supply the citizens of Copenhagen with water. By some ingenious method (which some day will be the subject of an interesting "Now It Can Be Told" story), the populace managed to obtain supplies thus thwarting their oppressors.

Using water as a weapon against conquered civilians is barbarous enough, but against helpless subjects in concentration camps, Himmler's lieutenants wielded water in an unprecedented manner as an instrument of depravity. American soldiers who liberated the camp at Buchenwald found that just before fleeing, the SS guards had destroyed the water system and drained the camp reservoirs. The more hardy of the surviving inmates were seen wandering about with buckets and pitchers in search of water to quench their scorching thirst. Army trucks were diverted to bring up water; but they could not supply enough.

At Dachau, most notorious German concentration camp, the tragedy of Buchenwald had been repeated. By the time Patton's men reached the camp they found the prisoners drinking water from a supply which was contaminated with seepage from 6,000 graves nearby.

As the European war drew to a close inside the borders of the Reich, water conditions became increasingly deplorable. When the Seventh Army approached Munich, members of the German underground seized the radio station and appealed to the citizens to prevent the Nazis from wrecking the water system. Unfortunately, the appeal was unavailing. On entering the city, Patch's divisions found that the city was without running water.

At Magdeburg, fanatical Nazi boys challenged the advance units of the Ninth Army to do their worst. After failing to persuade the youths that they were fighting against hopeless odds, the Yanks engaged them in a short but fierce battle. By nightfall the city was in ruins, the waterworks completely destroyed. Deprived of their water supply, civilians committed all sorts of crimes to obtain what dribbles were available.

In Berlin, where he had frequently attended the Wagnerian version, Hitler met his own Götterdammerrung. As Russian troops blasted their way to the center of the city they reduced the city to rubble. In describing this destruction, one Soviet correspondent concluded:

"We are not cruel men but we regard this without pity. We remember Leningrad, and we remember Stalingrad."

In addition to levelling houses and barricades, Red artillery also shelled water mains thus releasing spouting geysers. In this work they were abetted by British airmen who bombed pumping facilities. Soon the entire Berlin water system was out of order. Reservoirs were fouled with floating corpses, and broken water lines were contaminated with sewage. During the last terrible days, Berliners stood in line night and day waiting to scoop up a bucketful of water from broken mains and hydrants. In those sections of the city under direct fire, those overtaken by thirst had to run the gauntlet of shellfire to lap up brackish water from bomb craters.

The Soviets, having access to outside supplies, crammed water cans into tanks which then rumbled from unit to unit doling out the precious liquid ration. Grimy Russian soldiers battling die-hard Nazis in underground sewers and subways would emerge to gulp down ladlefuls of water. Then they would again descend to resume the grim tactics so well learned at Stalingrad.

Delegates to the Potsdam conference, inconvenienced by diarrhea contracted from bad drinking water, experienced first hand the realization that victory in Europe by no means solved the vital problem of water supply. Because of widespread typhoid epidemics, Allied authorities isolated the Netherlands for two months after her liberation.

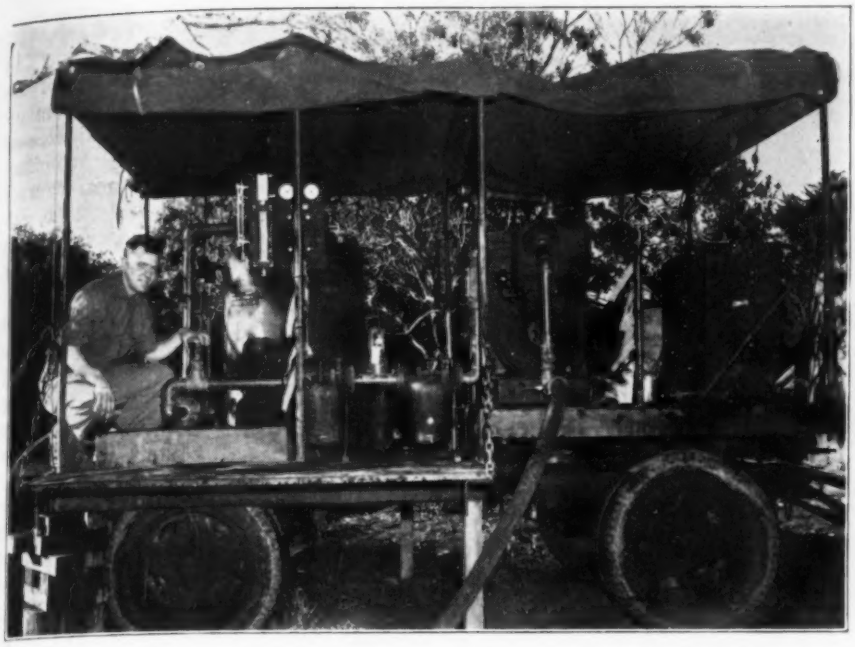
In the Spanish-American War almost four U. S. soldiers died of diseases for every one killed in action. Therefore it is no exaggeration to state that advances in the prevention and treatment of disease were responsible to a large extent in facilitating the defeat of the Japanese.

Cholera, typhoid, and dysentery were ever present water-borne diseases that menaced our Pacific forces. Contrasted to the disinfected European supplies which we impounded, island supplies in the Pacific theater often were polluted. Prior to invading the Philippines our troops were instructed to distrust untreated water and to drink only boiled or chlorinated supplies. The danger of taking a chance on untreated natural water was impressed during the briefing ceremony which included descriptions of the frequent water-borne epidemics which have plagued Philippine history. Because of the prevalent water pollution on Okinawa, all invasion troops there were given typhoid inoculations.

Water at Sea

"Water, water, everywhere, nor any drop to drink" well expresses the tortured feelings of those adrift at sea. Salt water is unsatisfactory because it upsets the body's chemical equilibrium — requiring twice as much pure water to restore the proper balance. In other words, salt water simply makes one thirstier.

The harrowing experiences of Captain Eddie Rickenbacker and his companions forced down in the vast expanse of the Pacific early in the war, focussed attention on methods of providing marooned personnel with potable water. Rickenbacker used the customary method of the shipwrecked—catching rain in handkerchiefs or other available cloth and wringing them out. Using a similar technique, Poon Lim, a Chinese seaman, obtained water while adrift at sea for 133 days.



(Marine Corps Photo)

A Marine Corps Mobile Water Purification Unit

A complete unit in all details from raw water pump to chlorinator attached to pressure filter.

When a large transport or warship is sunk, the crew and troops can escape on large lifeboats adequately stocked with water. Fliers, on the other hand, ordinarily carry only a pint container of this vital fluid. Hence when they are forced down at sea, pilots must drift in small rubber boats with sufficient water to last only a few days (cases are known in which two to three ounces of water a day have sustained life for about a week, but for prolonged periods a pint a day is the minimum requirement).

Partial solution of this problem was accomplished by the development of a "rescue boat" loaded with supplies which were parachuted to survivors. Sea water was purified by two salt water stills operated from the heat of the boat's exhaust system. Two gallons of water were thus obtained for every gallon of fuel burned.

This system proved a godsend to survivors spotted by these rescue planes. However, there still remained the problem of supplying those who signalled in vain or who drifted outside the routes of passing ships and planes. To provide for this emergency, a small desalting bag was devised. Shipwrecked fliers filled this plastic container to the mark with sea water and dropped in a chemical briquet that on disintegration precipitated the salts which together with the sediment were retained on a built-in filter. About twenty minutes were required to purify the water, which was sucked out through a nozzle at the bottom of the bag. Each flier was provided with one of the kits and from six to fourteen briquets.

Water in the Jungles

The jungle proved to be another region where ingenuity was required to obtain water. Captain Richard Howard, Chief of Survival Section, Aero Medical Department, has aptly said:

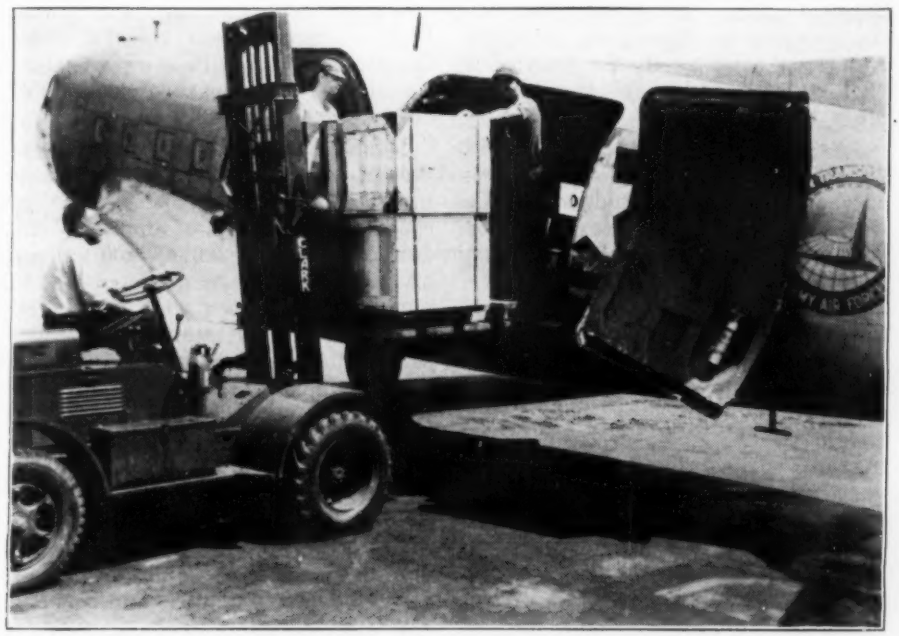
"Water is the most important requirement for survival in any climate and especially in the tropics."

Although the Japanese developed an efficient light portable filter, operated by a stirrup pump, to draw water from any shellhole, puddle, or swamp—our men found rainwater to be the jungle's most dependable and only safe natural supply. Tropical rains furnish abundant amounts —the problem is to collect it.

In Burma, native boys collected water in hollow bamboo tubes which they supplied to our fighters. Another method was developed by a veteran who dodged the Japs on Guam for two and a half years. He discovered that the wettest place on an island during a storm was under a cocoanut tree. Water collects on the leaves and then channels down the trunk where it can be trapped in cloths or shirts wrapped around the lower part of the trunk.

Beach-head forces found that on sandy beaches with high dunes, water could be obtained by digging. At a certain level fresh water exists as a layer over the salt water bed. In some instances water was even extracted from certain tropical plants and leaves.

Even the best water tastes somewhat flat when warm. To cool water supplies in tropical climates, scientists elaborated on the old Arab method of storing it in goatskin bags. A bag of duck cloth, treated with a synthetic thickener and a plastic coating, was fabricated. A small amount of the water stored in these bags seeps through to the outside surface where it evaporates thereby cooling the water inside 17 degrees below the temperature of the



(Army Corps of Engineers Photo)

Rush Air Shipment of W. & T. Portable Chlorinators to MacArthur, Back in Manila

Berlin Residents Had a New Experience. Waiting in Lines for the Precious Rationed Fluid—WATER

surrounding air. The extent of their use is indicated by the Army's purchase of 60,000 such bags.

The Jap generals who planned the defense of Iwo Jima either greatly underestimated the strength and endurance of U. S. Marines, or they planned poorly—probably the latter—for it has been reported that during the latter phase of the island campaign, the Japs were greatly weakened by lack of water. Evidently in accumulating vast quantities of arms and ammunition they failed to store sufficient supplies of water.

The Japs like the Germans, used water as a torture weapon. Marine Sergeant Calvin Graef thus describes the experience of eighteen hundred American captives in the hold of a "hell-ship" bound from the Philippines to Japan:

"As we moved through tropical waters, the heat down in that steel-encased hell hole was maddening. We were allowed three ounces of water per man every twenty-four hours. Quarts were needed, under these conditions to keep a man from dehydrating. While men were dying of thirst, Jap guards—heaping insults upon us—would empty five gallon tins of fresh water into the hold. Men caught the water in pieces of clothing and sucked the cloth dry. Men licked their wet skins. It was hell all right. Men went mad."

American forces also used water as a weapon—but only as a psychological and not a brutal one. On Okinawa the Sanitary and Medical Corps had trouble aplenty in supplying our own forces with sufficient water. Therefore to avoid the burden of supplying the natives, propaganda leaflets were showered on them which stated:

"The Japanese Army has plenty of food and water. Demand that they take care of you. They are responsible for the fact that you cannot provide for yourselves. Make the Japanese give you food and water!"

As grim retribution for their own barbarous use of water, the air attacks over Tokyo early in 1945 disrupted the water system to such an extent that a typhoid epidemic ensued.

Water on the Home Front

Water activities on the home fronts although less colorful than those on the firing line, nevertheless constituted an essential part of the defense program.

During the blitz, English water engineers faced the task of maintaining supplies under attack. During the repeated bombings of London, the daily demand for 300,000,000 gallons of water was met by augmenting the normal distribution with supply by tank wagons and standpipe dispensaries. Even bombproof shelters were built to shield the small scattered emergency reservoirs.

Water supplies in this country were free from direct attack, but not from the threat of sabotage. It has been revealed that the crippling of New York City's water supplies was the chief objective of the German spies landed on Long Island early in the war. As late as December, 1944, waterworks officials were cautioned to continue their vigilance against sabotage.

There was no "business as usual" for U. S. waterworks personnel. In addition to providing water for the influx of war workers, many municipal systems had to meet increased industrial demands. The manufacture of one 500-pound anti-aircraft gun barrel alone requires 2850 gallons of water, while the dyeing of a soldier's shirt uses 85 gallons of pure water. One large steel mill swallowed two and a half million gallons of water per day to produce needed metal. These, and an-all out effort to conserve fuel for pumping and chemicals for treatment, are some of the reasons why we were requested to conserve water by such posters as:

USE WATER WISELY

120 drops per minute

wastes

429 gallons per month.

★

(An AWWA Poster)

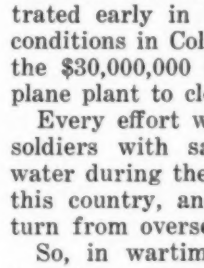
The direct dependence of war production on water was strikingly illustrated early in 1945 when drought conditions in Columbus, Ohio, forced the $30,000,000 Curtis-Wright warplane plant to close.

Every effort was made to provide soldiers with safe and wholesome water during their camp training in this country, and also on their return from overseas.

So, in wartime as in peacetime, American waterworks personnel render indispensable services.

Charles L. Pool to Bolivia for I.I.A.A.

The Institute of Inter-American Affairs has announced the appointment of Charles L. Pool to be Chief of Party in Bolivia. Mr. Pool, a graduate in Sanitary Engineering from M. I. T. with a Master's degree in Sanitary Engineering from Harvard, will succeed Maj. A. E. Williamson, who is returning to the States after a year in Bolivia. Mr. Pool has an outstanding record of 20 years' service in sanitary engineering.



From 1941 to 1945, he was on military leave from the Rhode Island State Health Dept., and served as a Commander in the C. E. Corps of the U. S. Navy.

SELECTING DEEP WELL CENTRIFUGAL PUMPS*

PART IV

By AXEL O. FABRIN
Pump Designer
MEMPHIS, TENN.

ONE of the essential keys to fine engineering achievement is the intelligent use of application data. The real test of engineering lies in performance and when the customer says a machine does a job superlatively well, then something worthwhile has been achieved. The deep well centrifugal pump is one of many machines that depends upon correct application data for successful field performance. Such data differ from the theoretical hypotheses that flourish in academic discussions, in that they are the best fruits of such symposia, applied in laboratory experiments on machines that have been designed according to fundamental laws.

The Author

Progressively the machines are modified to incorporate improvements planned to match patterns delineated by reactions obtained in the field of operation. It is the urge to excel in utility and performance that inspires new design and improves the old. When laboratory and field results are reconciled, data are prepared for the use of professional engineers. So delightfully smooth is this process of transition, that it is almost impossible to draw lines of demarcation for each factor as it comes into play.

New fields of operation and changing conditions justify continued research, for it is in the laboratory, when necessity requires, circumstances can be varied at will and conditions artificially created that make it possible to quickly determine improvements that otherwise might require years to materialize. Such a cycle overcomes the rigidity of mistaken opinions that can prevail in the absence of control.

A broad and general view of the activity of these forces in their operations together can be obtained by using a biological analogy. Inferior specimens in the animal kingdom are weeded out, and there remains a group which nature has produced, possessing varying degrees of fitness. The weaker in this group do not survive to reproduce; only the stronger remain to recreate a stronger strain. Progressive generations, while still retaining their basic characteristics, tend to a higher mid-parent, represented by a mean between the varying degrees of excellence in the remaining group.

We can extend the biological analogy into the field of manufacture, and, while this field is intimately connected to that of engineering, it differs in respect that it is not under the direct influence of or subject to the demands of the purchaser. It is twice removed, since engineering must first interpret the sales demand and then plan accordingly. When the designing period ceases, production should begin. Because of the natural and inevitable sequence of steps in manufacture, production lags behind the ideas and expectations of the discriminating purchaser. How much this lag should be, in terms of time, depends upon several factors, such as sales demand, engineering alertness, policy of manufacturer.

Manufacturing policy is perhaps the greatest intangible, as it varies according to the type of machine, and it changes as the development of the object progresses. The modern deep well centrifugal pump has attained its high degree of perfection in less than forty-five years. Like the primary stage of science, which is observational, the many and various designs in the early part of this century were the results of observations on cut and try methods of engineering.

Manufacturing Policy

In this period, the accumulation of drawings and patterns has been quite great, and except for the sake of repair service, a large percentage of pump types can be considered obsolete and should be retired from production. Reluctance in retiring machine designs is to a certain extent excusable, if in development, minor changes come so rapidly that supplanting complete old designs would incur financial loss to the manufacturer.

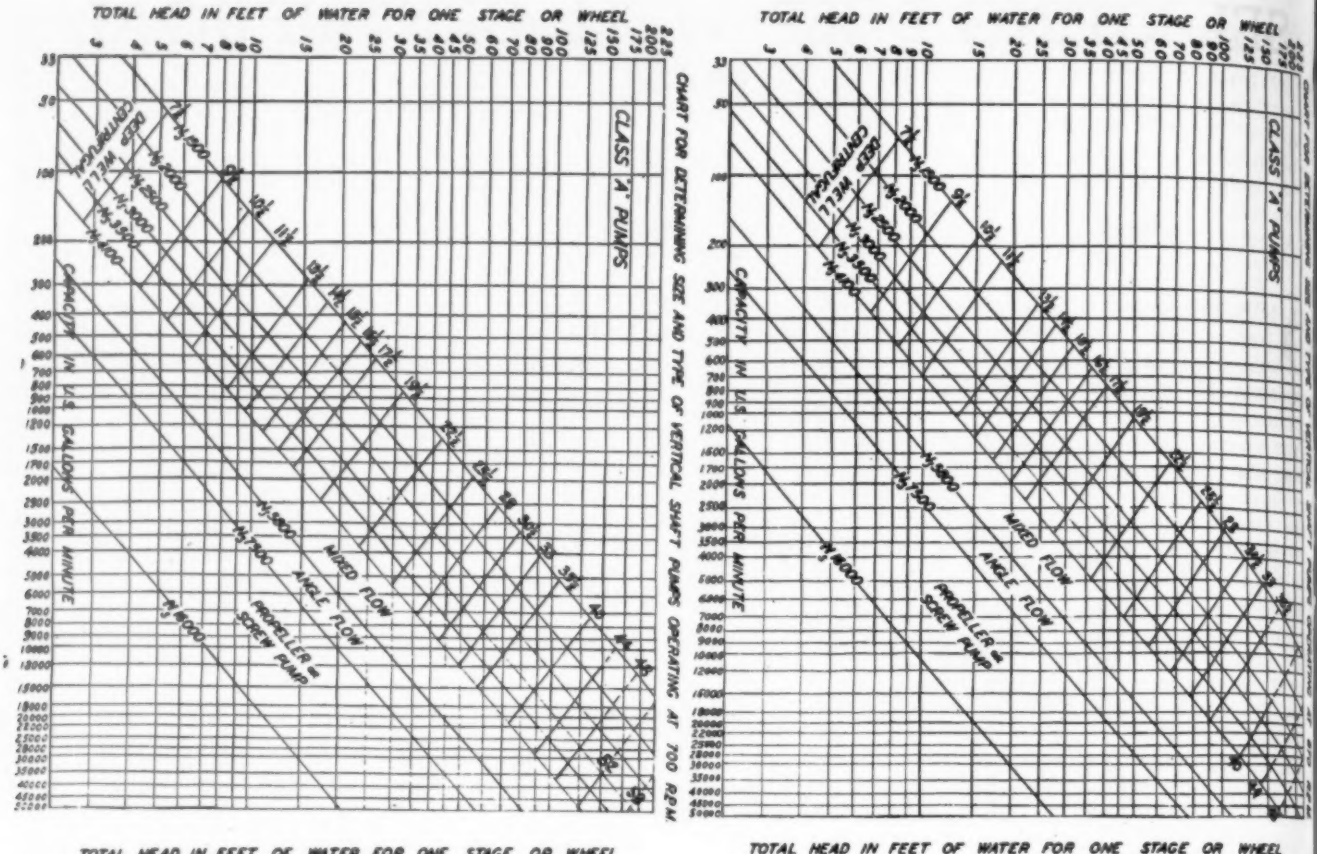
The rate at which designs have improved has been greatly accelerated in the past 20 years, and under the stress of war emergencies, engineering has been more active and creative than ever. This great energizing factor has been dedicated to bringing about complete final victory of war material; the abilities in design and engineering have been planning to use the cumulative results of their experience for the benefit of peacetime enterprise. The manufacturing skills that have been devoted to vital war work will bring to industry the "know how" and "can do" that made possible the quick conversion from peacetime products to precision ordnance. There is no doubt about the beneficial effect all this will have upon future deep well centrifugal pumps.

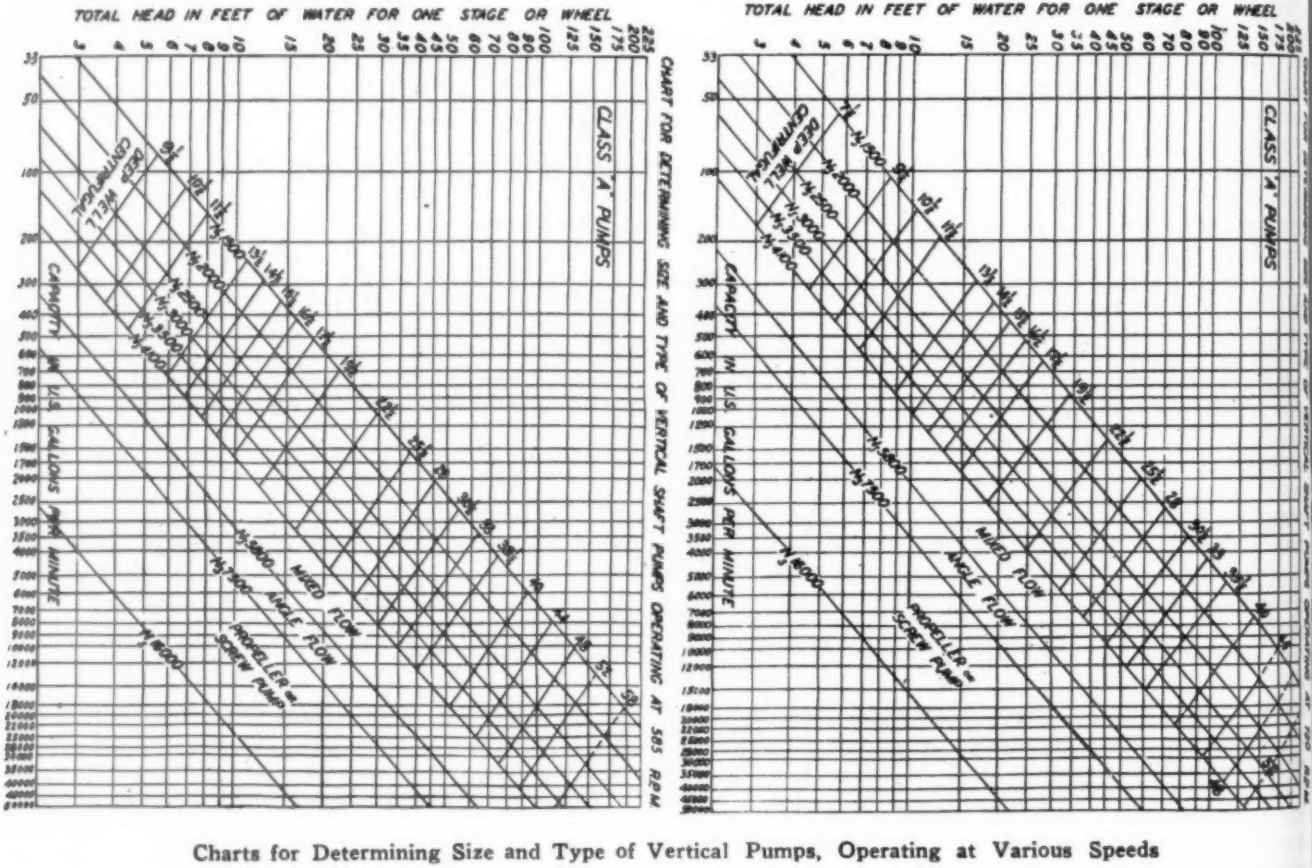
Consulting engineers, waterworks men, and farmers who depend upon irrigation for crop raising, are naturally interested in improved wells and modern pumps. Generally they know the approximate water supply obtainable from wells in their territory, or can procure such information. Data of this type increase in value as the volume of records swells. The more abundant the files on the subject of water resources, the more complete will be the reflected picture of the natural phenomena which control them.

Specific Sizes of Pumps Cannot Be Prescribed for Variable Natural Resources

Since man has no immediate control of these variable natural resources, specific sizes of pump and well cannot be prescribed which for a given capacity would be suitable for all localities. There are some sections in northern Illinois where, due to the action of glaciers, the geology of the earth has been so distorted that a 12-inch well yielding 500 gpm. would be considered excellent.

* Part I of Mr. Fabrin's article on "Selecting Deep Well Centrifugal Pumps," appeared in October 1944, Part II in November 1944, and Part III in May 1945.

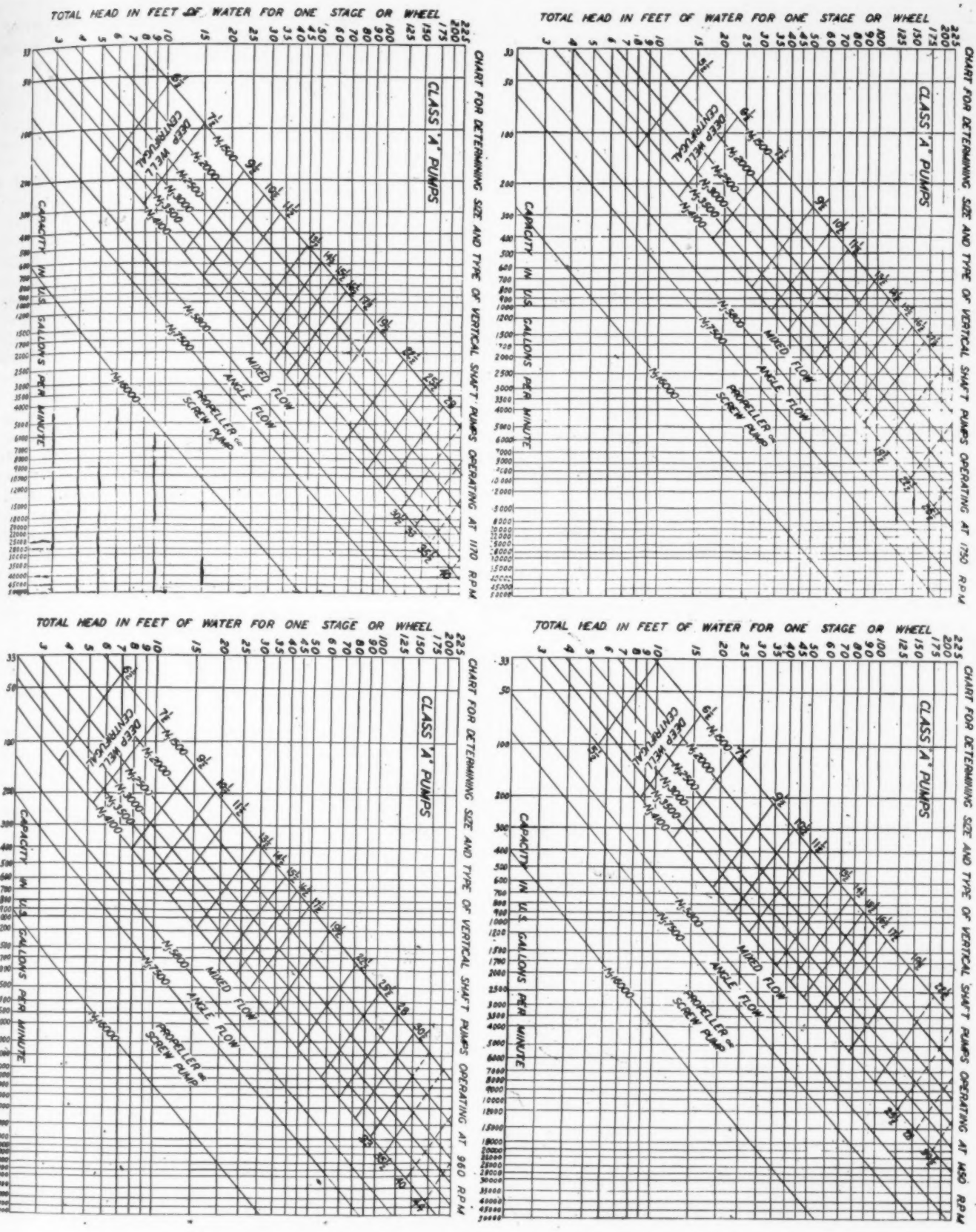

TOTAL HEAD IN FEET OF WATER FOR ONE STAGE OR WHEEL
CAPACITY IN U.S. GALLONS PER MINUTE
CLASS "A" PUMPS
CHART FOR DETERMINING SIZE AND TYPE OF VERTICAL SHAFT PUMPS OPERATING AT 700 R.P.M.
DEEP WELL CENTRIFUGAL
MIXED FLOW
ANGLE FLOW
PROPELLER OR SCREW PUMP


TOTAL HEAD IN FEET OF WATER FOR ONE STAGE OR WHEEL
CAPACITY IN U.S. GALLONS PER MINUTE
CLASS "A" PUMPS
CHART FOR DETERMINING SIZE AND TYPE OF VERTICAL SHAFT PUMPS OPERATING AT 585 R.P.M.
DEEP WELL CENTRIFUGAL
MIXED FLOW
ANGLE FLOW
PROPELLER OR SCREW PUMP

Charts for Determining Size and Type of Vertical Pumps, Operating at Various Speeds

Debris deposited by these glaciers formed what is known as moraines, and the irregularity of these deposits confused the earth strata by indiscriminate distribution of material so that wells in close proximity to each other often vary widely in characteristics.

In other sections of this country the earth strata is composed of alluvial deposits regular in form and depth. Arkansas has territories where the uniformity of the geological structures provides water bearing formations supporting 12-in. wells with productions up to 2,000 gpm. Fortunately, well water for agriculture can be developed in large


TOTAL HEAD IN FEET OF WATER FOR ONE STAGE OR WHEEL
CAPACITY IN U.S. GALLONS PER MINUTE
CLASS 'A' PUMPS
DEEP WELL CENTRIFUGAL
MIXED FLOW
ANGLE FLOW
PROPELLER or SCREW PUMP
CHART FOR DETERMINING SIZE AND TYPE OF VERTICAL SHAFT PUMPS OPERATING AT 1170 R.P.M.
CHART FOR DETERMINING SIZE AND TYPE OF VERTICAL SHAFT PUMPS OPERATING AT 1750 R.P.M.
CHART FOR DETERMINING SIZE AND TYPE OF VERTICAL SHAFT PUMPS OPERATING AT 960 R.P.M.
CHART FOR DETERMINING SIZE AND TYPE OF VERTICAL SHAFT PUMPS OPERATING AT 1150 R.P.M.

Charts for Determining Size and Type of Vertical Pumps, Operating at Various Speeds

sections of some of our Western States, where the salubrious climate and the fertile soil invite government action in offering tracts of land for occupation by returned service men.

Charts for Selecting Pumps of Proper Proportions

Selecting pumps of proper proportions for different well yields is important, and since wells must be large enough to accommodate the pumps, it follows that charts embodying data on proper size for certain capacities would be quite useful. Such charts are presented herewith and a brief explanation will enable

those interested in water supply to use them to the best advantage.

The charts are prepared for deep well centrifugal pumps designated as Class A, which are the most efficient and are larger in diameter than Class C pumps. They are recommended for duties where essentially long periods of operation are required. Such pumps, because of relatively high efficiency, will by reason of power economy justify the cost of a large diameter well.

Class C pumps are less efficient than the A class, as they are of smaller diameter. Since the wells will be smaller, they are also less expensive, and where the duty is intermittent and the operation period during a year is of short duration, the cost of wasted power due to less efficiency than that of Class A will not equal the interest or the extra cost of a well suitable for a large Class A pump.

The method of selecting the class of pump with due respect for economy of operation was presented in Parts I and II.

There are two general types of pump applications that require Class A pumps; they are the public utility field and some industries.

Class C pumps are in favor where agricultural irrigation extends over a short period of the year, and they can also be used to good advantage in industries of seasonal activity such as the canning business. In support of the charts which are designed to determine pump sizes, several instances are given herewith.

Case No. 1

Required a water supply for a small city located in northeastern Illinois. A survey indicates that the strata of Niagara limestone will, because of faults, fissures and crevices, supply a 12-in. diameter well with a normal capacity of 450 gpm. The electric power characteristics are 60 cycle, 3 phase so a 1750 rpm. motor can be used. With a pumping level of 97-feet and a 75-foot elevated tank, the total head becomes 172-feet. If the water is discharged direct into the mains, the elevated tank is obviated, but the pump pressure at the surface should be the equivalent of 30 to 35 lb. for domestic services, which is essentially equal to the head from an elevated tank 75-feet high.

From the 1750 rpm. chart, it can be seen that the pump can be either an 11½-in. in diameter Class "A" unit of 3 stages with an Ns of 1800, or 9½-in. diameter Class "A" pump, 5 stages, with an Ns of 3000.

If steel casing is not used, as is often the practice in rock well construction, there may be protrusions encroaching on the normal diameter that make it difficult, if not impossible, to install the 11½-in. diameter pump. The choice reverts to the 9½-in. pump, which because of the higher Ns, will be slightly better in efficiency.

Case No. 2

Two hundred seventy five acres of rice to be irrigated using a pumping rate of 1800 gpm. for 75 days, operating 24 hours a day. In northeastern Arkansas rice fields procure their irrigation water from an alluvial stratum that makes possible wells of 12-in. diameter for 1800 gpm. It is, of course, recommended that, where conditions permit, the well casing should be larger than 12 in. With the pumping level 48 ft. and discharge at the surface direct into the irrigation header requiring no head above ground, the total head and pumping level is the same.

Referring to the 1750 rpm. chart, it is seen that a pump 12¾ in. will be suitable. This is a Class A unit, but since the duty of the pumping plant is intermittent and the period of operation relatively short, a Class C pump is satisfactory. The diameter of Class C pumps are generally 90 per cent of the A Class, so accordingly, the pump in our problem will become 11½ in. in diameter. Further reference to the chart indicates a single stage pump will meet the hydraulic conditions.

When using these charts, it must be borne in mind that deep well centrifugal pump manufacturers have standardized on certain sizes and if interpolated values from the charts denote diameters falling between two standard values, use the size nearest the interpolated point.

It is realized that there are conditions where, because of the graduation of pump sizes, the choice of pump class is optional. This is especially true when the choice is confined to one speed.

Where the nominal pump size exceeds 14½ in., there may be circumstances where a municipal pump problem reverts to a choice between a high and low speed pump. Because of the low first cost, there may be a temptation to use a high speed Class C pump instead of a low speed Class A. If a complete analysis is made according to the outline in Parts I and II, it can be shown that false economy may obtain if operating expense is not given full consideration.

If the problem of size determination is approached from an engineering point of view, and action is in accord with good engineering judgment, it is certain that the dependent financial result will be favorable with a Class A pump.

Reflecting on these remarks and considering the examples, Case No. 1 and Case No. 2, it will be observed that the charts do not predicate arbitrary procedure or prescribe inflexible values. These charts show finite pump diameters for various capacities, and heads per stage when the revolutions per minute are shown. There are eight (8) charts, covering eight (8) different motor speeds, ranging from a high speed of 1750 to a low of 585 rpm. This will take care of the majority of deep well centrifugal pump problems using 60, 50 or 25 cycle motors.

While precise dimensions are indicated, certain tolerances are acceptable. The charts pertain to a collection of pumps, all of homologous design, but by slightly modifying the impeller vanes at the periphery, the head can be increased at least 10 per cent for any size, and in some instances more. If, after taking advantage of the 10 per cent margin, the choice falls between two standard sizes, use the larger.

The addition of one or two blades in an impeller will boost the total head per stage more than 10 per cent, but often this results in a pump with a pressure volume characteristic a little too flat for good well operation. Parts I, II and III concern the selection of the proper class pumps with respect to economy.

"Jerry" Svore Appointed State Sanitary Engr. of N. Dakota. Succeeds L. K. Clark, Resigned

"Jerry" Svore

Col. L. K. Clark has resigned as Director, Div. of Sanitary Engineering, State Health Dept. of No. Dak. Col. Clark returned to the Department in December after having spent nearly five years on active duty in the Sanitary Corps, two years of which were in the South Pacific. He has accepted a position with the Association of American Railroads to work toward a solution to the many problems of railroad sanitation.

J. H. (Jerry) Svore has been appointed Director of the Engineering Division to succeed Col. Clark.

OKLAHOMA A. & M. HOLDS 19th W. & S. SHORT COURSE*

SIXTY-ONE individuals registered for the Nineteenth Water and Sewage Short Course held at the Oklahoma A. and M. College, Stillwater, Okla., January 21 to 25. Twenty-six cities were represented at the school.

In conducting its water and sewage short courses it has always been the policy at the College to use regular classroom and discussion methods of instruction, rather than to have a long series of formal papers presented. Men attending the courses state they absorb a great deal more information from this type of instruction and find it much less monotonous and tiring.

Instruction at the course was given in two major fields or groups, "Water and Sewage Treatment Processes" and "Bacteriology." Under the first heading daily class instruction was given on Principles of Water Purification and Principles of Sewage Treatment. Special topics also included were "Tastes and Odors," "Equipment Maintenance" and "Plant Records."

What is believed to be a new departure in programs at water and sewage meetings was the four periods devoted to the subject, **"Getting Along on Your Job."** Glenn Smith, head of the Department of Trade and Industrial Education at Oklahoma A. and M., made admirable use of the conference method in developing such topics as "Understanding Job Relationships," "Personal Traits and Characteristics," "Your Boss and Fellow Workers," and "Planning and Teamwork."

In the instruction in Bacteriology, actual laboratory practice was given in preparing standard and special media, sterilizing glassware, sampling, making presumptive and confirmatory tests, reading and interpreting test results, and in the use and care of the microscope. Under a special topic, "What to Get and Where to Get It," plant operators were given advice on laboratory equipment needed and told how some of it could be homemade.

At the annual conference dinner held on Wednesday evening, Major C. E. Perkins, C. E., gave a vivid description of personal experiences in rebuilding and maintaining municipal utilities in occupied France and Germany. The following day Captain S. Karl Bean, C. E., detailed some of his interesting experiences in supervising the operation of Army water and sewage plants.

For attendance at all sessions of one group or the other, thirty-three men received certificates.

Instructors in various parts of the short course program not previously mentioned were as follows:

Principles of Water Purification—

Frank S. Taylor, Filtration Engineer, Oklahoma City Water Dept.

Principles of Sewage Treatment—

W. S. Mahlie, Chemist in Chg., Water and Sewage Purif., Ft. Worth, Texas.
W. H. Wisely, Exec. Secy., Federation of Sewage Works Assns., Champaign, Ill.

Tastes and Odors—

Dr. Harrison Hale, Prof. Emeritus of Chemistry, Univ. of Arkansas, Fayetteville, Ark.
Dr. O. M. Smith, Head of Dept. of Chemical Engineering, Okla. A. and M. College.

Maintenance of Equipment—

W. N. Remsburg, District Eng., American Well Works, Aurora, Ill.

Plant Records—

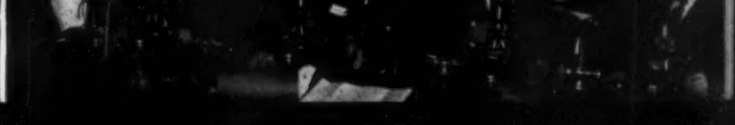
Grover L. Morris, Asst. Sanitary Eng., Okla. State Health Dept.

Bacteriology—

Dr. E. E. Harnden, Assoc. Prof. of Bacteriology, Okla. A. and M. College.
Dr. W. H. Irwin, Assoc. Prof. of Zoology, Okla. A. and M. College.
Dr. T. L. Johnson, Assoc. Prof. of Bacteriology, Okla. A. and M. College.
E. E. Jeffers, Asst. Prof. of Bacteriology, Okla. A. and M. College.
Miss Katherine Aderhold, M. T., Laboratory Consultant, Okla. State Health Dept.

Frank S. Taylor Lecturing on Principles of Water Purification.

Learning Use of Microscope. In rear is W. S. Mahlie, Lecturer on Sewage Treatment.



*A report by Edward R. Stapley, Acting Dean of Engineering, Oklahoma A. and M. College.

SLUDGE DENSITY CONTROL

With Particular Reference to Return Sludge Chlorination

By JOHN A. TAPLESHAY
Manager, Installation & Operation Dept.
CHICAGO PUMP CO.,
CHICAGO, ILL.

IN the past six years the author has had the opportunity of supervising the initial operation of more than 50 activated sludge sewage treatment plants of various sizes and types in all sections of the United States. These plants ranged in size from small "Package" Combination Aerator Clarifier plants, treating 30,000 G.P.D., to conventional diffused air plants treating from 0.5 to 20.0 M.G.D.

The Author

The Sludge Index

"Sludge Index" is the term used to express the settleability of the suspended solids and therefore density of the sludge after a given settling period.

$$\text{S.I.} = \frac{\%\ \text{Settleable Solids}}{\%\ \text{Suspended Solids}}$$

To most operators of activated sludge plants the control of the sludge index to insure proper settling and clarification ranks high among the problems in plant operation. Use of the sludge index as an operational control measure has become almost universal since it was first proposed by Donaldson in 1931 and later by Mohlman[1] (1934) in a modified form. To most operators it provides one of the surest means of determining the sludge conditions. The index of any activated sludge is dependent upon four principal factors which will vary from plant to plant. These factors are: (a) the physical characteristics of the plant, (b) the strength and characteristics of the sewage, (c) the concentration of solids in the mixed liquor, (d) the rate of return sludge.

The physical characteristics of the plant, such as the type of aera-

[1]Mohlman, F. W. "The Sludge Index," Sewage Works Journal, 6, 1, 119 (Jan. 1934).

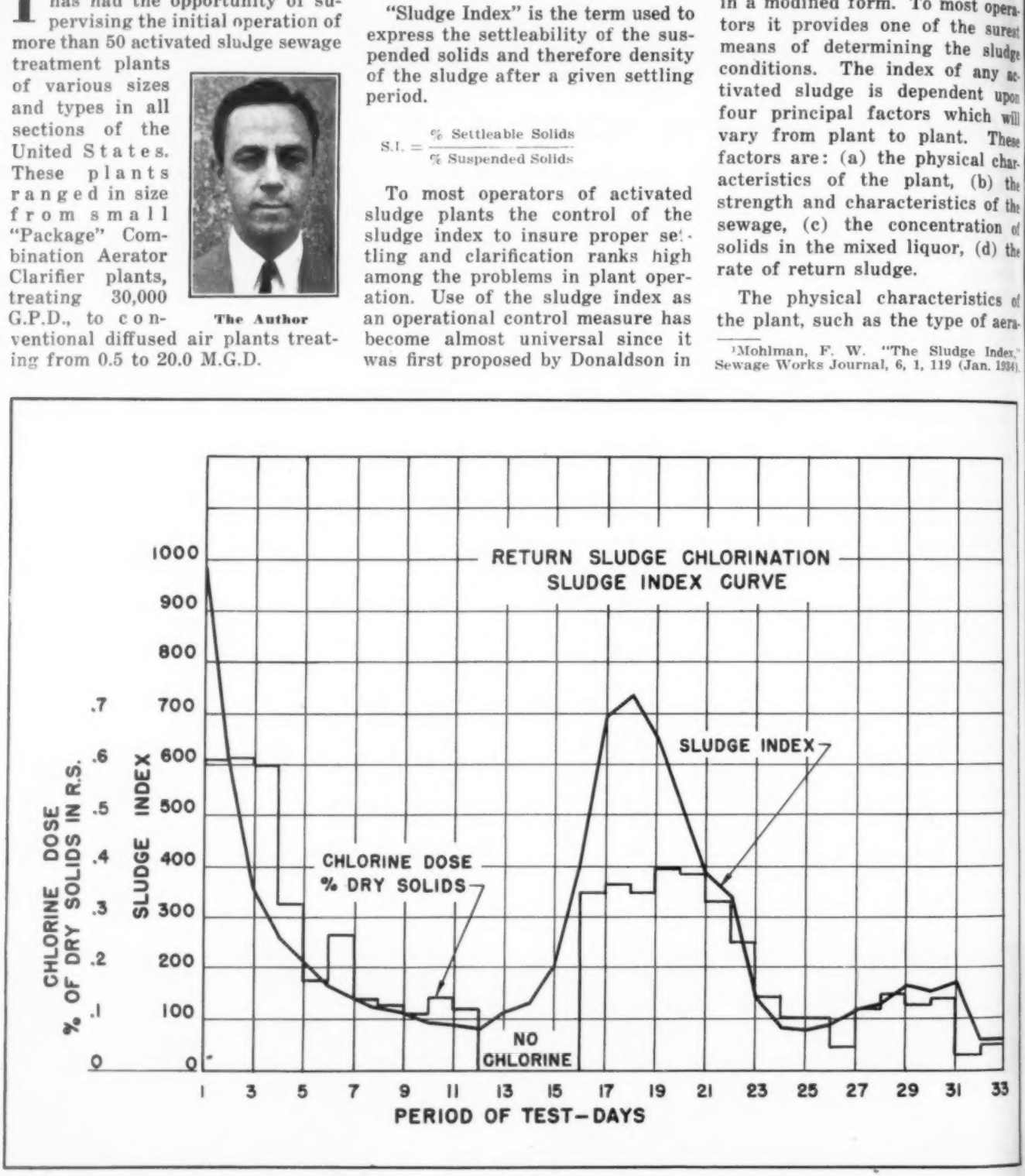


Fig. 1—Effects of Return Sludge Chlorination on Sludge Index and Plant Performance

tion employed and the aeration period, have a most important bearing on the index. Plants using mechanical aeration usually operate with indices three to five times higher than those using diffused air, principally because the concentration of mixed liquor solids in the diffused air plants can usually be maintained at a higher figure due to the more efficient aeration.

The most important factor which determines the index is of course the strength of the sewage, and since this varies considerably from plant to plant it is only natural that the proper index will vary likewise. Then too, actual strength of the sewage in B.O.D. alone does not give the entire picture, for the characteristics of the sewage may have a decided bearing upon the proper index.

The concentration of solids in the mixed liquor usually has a definite bearing on the sludge index as in most cases the lowest index is obtained when the solids concentration is relatively high. This is true because a higher concentration of solids allows the plant to absorb increased loads or greater shocks with less disruption of sludge quality.

Unfortunately, many plants cannot maintain very high solids due to air limitations or for economic reasons.

Regulation of the rate of return sludge has a definite influence on the sludge index since by its regulation you balance the mixture of sludge with the load going to the aeration tanks. To have perfect control of the activated sludge process the rate of return sludge should be maintained at a constant percentage of the flow; however, this is seldom done as most operators maintain a rate which will give, what they consider, the proper return for the *average* 24 hour flow.

In order to determine the index at which any plant performs best it is necessary to operate with the index at various points and compare plant efficiencies and performance at these various points. Having once established a normal or optimum index any abnormal increase of this figure can then be considered an indication of trouble, providing all other variables have remained constant.

An abnormal increase in the sludge index is quickly reflected in plant operation by poorly settling sludge, rising sludge blanket in the final tanks, and finally sludge pouring over the effluent weirs. It may or may not be possible to immediately determine the cause of the increase but in most cases adjustment of the air applied, the mixed liquor solids concentration and the return sludge rate, will correct the conditions. When all the ordinary corrective measures fail the index can usually be brought under control by the application of chlorine to the returned (recirculated) sludge.

Chlorination for Sludge Index Control

Chlorine has been employed in many instances for control of bulking sludge; in some cases its use has been successful; in others it has not. Most of the failures were due

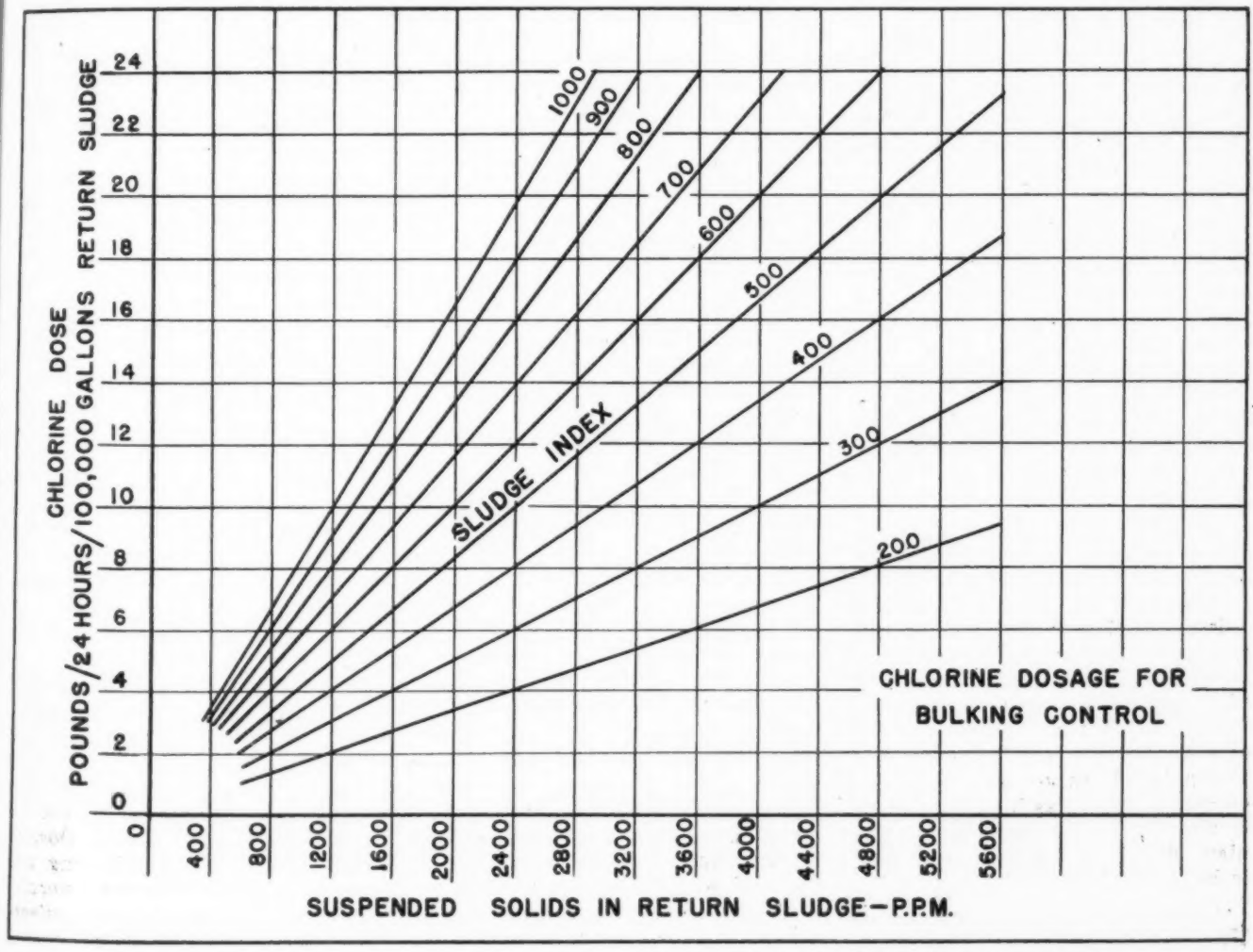


Fig. 2—Chlorine Dosage Chart—Return Activated Sludge Chlorination for Sludge Index Control

to inadequate control of the dosage or lack of information as to the proper dosage. A few users have based the chlorine dosage on the amount of dry solids in the return sludge, while more have figured the dose on a flow basis only.

During a period of three years while supervising initial operation of Army sewage treatment plants, the author had the opportunity of doing considerable experimentation with the use of chlorine to control the sludge index and, thus, eliminate the trouble caused by bulking sludge.[2] Experiments were carried on at several different plants and sufficient data collected to determine a method of closely approximating the chlorine dose needed to control the sludge index, and at the same time avoid over-chlorination.

Without going into complete detail of the experiments conducted, it was found that chlorine, when applied to the return sludge at a point which allowed at least 2 minutes' contact period and in a dosage based upon the sludge index and the weight of dry solids in the return sludge, would result in a definite predictable improvement in sludge index. Figure 1 shows a typical curve, taken from one of the experiments at an Army Camp, in which the sludge index was very high at the start of chlorination but was reduced materially in a few days. From this curve it can be seen that the chlorine dosage follows the index curve very closely. This fact is essentially the basis of a formula which was derived from the experiments. This formula is:

$$CD = F \times W \times S.I. \times .0000834$$

Where—

CD = Chlorine requirement in lbs./24 hrs. for each 100,000 gpd. of sludge returned.

F = return sludge flow in mgd.

W = suspended solids in return sludge in ppm. by weight—dry basis.

$$S.I. = \frac{\% \text{ Settleable Solids}}{\% \text{ Suspended Solids}}$$

As stated previously the necessity of using chlorine in the return sludge for sludge index control should first be established before it is put to use. While chlorine will control the index it must be remembered that it will increase the cost of operation somewhat and if ordinary corrective measures will give comparable results they should be employed. In general, if the increase in index has been caused by a temporary unbalancing of the plant due to a lapse in control it is better to first try to restore the balance by routine adjustments, since this method will serve best to acquaint the operator with the effectiveness of such adjustments. If the increase in index has been caused by an overloaded condition which cannot be relieved by ordinary adjustments in control measures, chlorine can be advantageously used.

Point of Application and Amounts

The chlorine should be introduced into the return sludge at a point which will allow *at least* 2 *minutes'* contact period before it mixes with the primary effluent. This means that in most plants it will be introduced between 120 and 240 feet from the point of mixing with the primary effluent since the velocity in the average return sludge line or trough is between 1 and 2 feet per second. Where it is not possible to introduce the chlorine into the return sludge line it can be applied in the common sludge hopper where return from the individual final tank hoppers is made.

The amount of chlorine to use can be calculated from the foregoing formula or taken directly from the curve shown in Figure 2. In either case, since the dosage is based upon the solids (dry basis) in the return sludge, the suspended solids in the return sludge should be obtained from a 24 hour composite sample. This is necessary since the suspended solids in the return sludge will vary throughout the day and a grab sample will give an erroneous figure. Also to obtain best results the rate of return throughout the chlorine dosing period should be kept at a constant percentage of the flow. This means that regulation of the return sludge rate is necessary especially during the low flow period at night.

The chlorine dosage as shown in Figure 2 is based upon a return sludge rate of 0.10 M.G.D. so that actual dosage to apply can be calculated as follows:

$$\frac{\text{Actual Rate of R.S. (MGD)}}{0.10} \times \text{Pounds of } Cl_2 \text{ as shown on graph} = \text{Dose to apply. (Lbs. per 24 hrs.)}$$

Reaction to Chlorination

When chlorine is first applied to return sludge there is usually a reaction within 12 hours. The first indication of this reaction is a clouding of the final effluent (a murky effluent) which is most pronounced when the index to start is very high, and the mixed liquor solids very low. As chlorination is continued the index drops rather rapidly, the solids build up and the turbidity of the effluent decreases. Usually a decided improvement in the index is apparent within three to four days. Keeping a record graph similar to that shown in Figure 1 will prove of considerable value in following the effects of chlorination and evaluating the results.

While chlorination is in progress it is seldom necessary to re-adjust the dosage from day to day even though the sludge index is decreasing. This is true because when chlorination is started the solids in the return sludge are usually low and one of the aims of chlorination is to increase these solids. As chlorine is applied the lowering of the index allows the sludge to settle and compact more, thus, rendering a more concentrated return sludge. In effect, even though the chlorine dose on a poundage basis remains constant, the amount fed on the basis of per cent of dry solids in the return sludge decreases.

Chlorination should be continued until the normal index has been obtained by which time the sludge character will have improved and the chlorine dosage will have been reduced. If the original upset has been due to a condition of short duration the chlorination can be discontinued, as the improved sludge will then handle the normal flow conditions. If the causes of the original upset are still present it may be necessary to continue chlorination as long as the cause exists. In either case, it is worth a trial to discontinue chlorination and observe the result. If the index immediately starts increasing it can be assumed that continued chlorination is necessary. In cases where continued chlorination seems advisable it is usually less costly to practice it, rather than to allow the index to follow a continuous cycle with chlorination being reinstated only when the index reaches a peak. In this case, the amount of chlorine needed to reduce the index from its high point to normal will usually be greater than when continued dosing with a small amount is practiced.

Chlorination of the return sludge can, therefore, be utilized in a great many instances where control of the sludge index cannot be maintained by usual measures. By employing the formula suggested or making use of the Chlorine Dosage Graph (Fig. 2), and following the procedures discussed and exercising ordinary judgment, upsets affecting sludge quality can be minimized if not completely eliminated.

[2] Tapleshay, J. A. "Control of Sludge Index by Chlorination of Return Sludge," *Sewage Works Journal*, 17, 6, 1210 (Nov. 1945).

HIGH CAPACITY TRICKLING FILTERS

Part II. Causes of Inferior Results

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IN PART I of this exposition on high capacity trickling filters, the topics of application, recirculation, B.O.D. removals, and filter efficiencies were discussed. In Part II it is proposed to present the causes of inferior results in trickling filters.

The Author

This study and interpretation of single and two stage high capacity trickling filter operation, and the causes for poor results, is necessarily of considerable length. In order to simplify its presentation, this article has been divided into three parts. To further simplify the presentation, the cuts, conclusions, and references are numbered consecutively in the three parts. The subtitles of the three parts are: Part I—Single Stage Filter Operation and Results; Part II—Causes of Poor Performance in Filter Operation; Part III—Two Stage Filters.

B.O.D. Load Applied to a Filter

Disappointing effluents from trickling filters have resulted because the designer failed to recognize that the quality of the effluent depends largely upon two factors, first, the pounds of B.O.D. applied to the filter per cubic yard of media, and second, the ppm. B.O.D. applied to the filter.

Edmondson and Goodrich,[11] in their studies of the "Cyclo-Nitrifying Filter," definitely showed much better results through the use of spray rather than hose-like application upon the filter surface.

The distributors used at Owatonna, Minn. (Table II, Part I) at the time of Walton's tests[4] had a centrifugal nozzle arrangement of the vitrified clay type that made it next to impossible to obtain anything even approaching good distribution. On the inner area of the filter the number of nozzles per square foot of bed area was entirely different from the number on the outer portion of the filter. These distributors were replaced in the Fall of 1944.

Mixing Plant Designs And Processes

Plants have been designed for low-momentary-rate operation (Aero-filter) and then have been equipped with high-rate distributors.

Reference to Table VI discloses that the overall B.O.D. removals by the single stage plants, when recirculation ratios of 0.5 or less were used, were: Army Base I, 53.5 per cent; Army Base VIII, 75.8 per cent; Glenwood City, 62.5 per cent; Webster City, Iowa, filter No. 1, 63.8 per cent, and filter No. 2, 57.2 per cent. Kessler[1] mistakenly referred to Army Base I as an Aero-filter. It was designed as such, but the distribution never fell within the Aero-filter range. At Army Base VIII, Glenwood City, and Webster City the distribution was not of the rainlike type recommended for Aero-filters. Due to the relatively high speeds of rotation, the 6-arm distributors at Army Base VIII, the 8-arm distributors at Webster City and the 3-arm motor driven distributors at Glenwood City bring the filters within the Aero-filter range. It should be noted that at Glenwood City and Webster City an 85 per cent overall B.O.D. reduction could only be attained by heavy recirculation. This recirculation was possible since the actual flow of raw sewage has been below that for which the plants were designed.

Rest Periods Are Harmful

Resting the filter, once thought essential, is now generally considered harmful because bacteria feed continually. Stoppage of a high capacity filter for a few minutes will affect the final effluent adversely. In the appendix to Walton's thesis,[4] but not revealed in the published article, he states that the lack of raw sewage flow caused the distributor at River Falls to stand idle several hours at night, and at Lakefield, Minn., for 10 to 15 minutes at intervals during the 24 hour period.

Army Base III (Table VII) is an excellent example of noncontinuous operation. Prior to November, 1943, when hand controlled recirculation was used, the B.O.D. reduction by the filters fell as low as 37 and 38 per cent, but during the following December, January and February, with automatic recirculation, the B.O.D. reduction by the filters of the load applied varied from 72.8 to 76.9 per cent, in spite of some small rock in the beds.

Digester Supernatants

The return of a bad supernatant from the digester through the plant causes trouble in almost any type of complete sewage treatment. Mason, Mich. (Table VIII), uses an old unheated Imhoff as a digester. In March, 1943, when a test of the digester revealed 800 ml. of solids per liter, regardless of the sampling depth, the B.O.D. reduction by the filters fell to 52.7 per cent, but for June, 1943, and June, 1944, the reduction amounted to 71.3 and 71.2 per cent, respectively. In July, 1943, the B.O.D. reduction by the filters rose to 81 per cent of the load applied without recirculation. All sampling is done during a seven hour day, since the plant does not have a night operator.

The plant at Lake Mills, Iowa, (Table III, Part I), during an official test gave a reduction by the filters alone in December, 1939, of 83.8 per cent, which included about a 1:1 recirculation, which agrees with curve B of Fig. 2 (Part I). At that time the digester was working satisfactorily, but during October 14-21, 1941, when Walton tested the plant, the overall reduction was down to 71.1 per cent, with the digester giving trouble.

Attention is called to the percentage B.O.D. reduction during the test of Aug. 2 at Detroit Lakes, Table X. The reduced plant efficiency is likely due to the return of a stronger supernatant than on the preceding days.

In small installations where an operator is not present the majority of the time, as in the case of Lake Mills, it would seem advisable to control the sludge pump operation by time clock in order to keep the clarifiers clean and at the same time prevent pumping too much cold water to the digester once or twice a day. A method should also be provided for

keeping a bad supernatant out of a sewage plant during such periods.

Oil and Grease

The proper removal of oil and grease ahead of a trickling filter as well as in an activated sludge plant is very desirable. The effect of excessive mineral oil is shown for Army Base A (Table IX), where bombers were assembled. With a heavy mineral oil content in the sewage the filters gave a B.O.D. reduction of 57.8 to 60.4 per cent, but after most of the oil was removed the reduction varied from 74.3 to 77.2 per cent of the applied load, settled sewage basis. Prior to 1944 the amount of mineral oil was so large that the ventilating fans on the filters pulled foam up 15 ft. through the 4 ft. square fan chambers. At times the foam was discharged through the fan turbines. Not only was the air passage blocked, but the effect of the oil on the bacteria must have been bad. Most of the oil trouble was eliminated by 1944.

Excessive Prechlorination

A little may be good, but too much is bad, especially when it comes to prechlorination. In several of the Army installations the entire biological growth on the filter has been lost by reason of too much prechlorination.

Primary Clarifier Operation

Poor primary clarifier operation prevents reducing the strength of the sewage applied to the filter, which in turn results in a higher ppm. B.O.D. in the plant effluent. It also often permits an excess of floating material to pass to the filter.

Filter Locations

Uncovered filter installations have been made under or adjacent to trees which shed their leaves and broken twigs on the filter surface.

Distributor Operation

In order to assure proper distribution on the filter surface at all times, regardless of the type of filter, it is important that the distribution nozzles be kept free of clogging material. If a reaction type distributor is not rotating correctly, one of two things is wrong—either the distributor has bearing trouble and is not operating freely or the sewage flowing to the distributor is insufficient to keep the orifices in proper operation and thereby provide good distribution.

Insufficient Operating Heads

It is essential that good distribution be maintained at all times if the best filter efficiency is to be obtained. In an effort to minimize costs there

TABLE VI

Single Stage Filter Operation Using Arm Distributors Without Raindrop Application

Location of Plant	Glenwood City, Wisconsin[4]			Webster City, Iowa[4] Unit No. 1			Webster City, Iowa[4] Unit No. 2			Army Base I (1)	Army Base VIII (1)
Dates of Tests	Feb. 4-13 1942	Feb. 13-28 1942	Mar. 3-7 1942	Nov. 10-15 1941	May 7-16 1942	May 13-14 1942	Nov. 10-15 1941	May 7-16 1942	May 13-14 1942	Oct., 1941 to Mar., 1942	June, 1941 to Mar., 1942
Av. of test numbers.	4,5,6,7,8	9,11,12,13	14,15,16	4,5,6	7,10	9	4,5,6	7,10	9	.....	.....
No. of 24 hr. composites	5	4	3	3	2	1	3	2	1	5 months	9 months
No. of filters.....	1	1	1	1	1	1	1	1	1	1	2
Mgd. of sewage											
Raw	0.0379	0.0336	0.0286	0.404	0.557	0.591	0.404	0.557	0.591	1.395	1.9
Creamery	0.0080	0.01385	0.0173	.....	.....	.....	.....	.....	.....	.....	.....
Prim. clarif. effl...	0.0379	0.0336	0.0286	0.9373***	1.012***	0.591***	0.9373***	1.012***	0.591***	.....	.....
To filter, including recirculation ...	0.166	0.125	0.0459	0.4686	0.506	0.2955	0.4686	0.506	0.2955	.....	.....
Final effluent	0.0459	0.0474	0.0459	0.202	0.2785	0.2955	0.202	0.2785	0.2955	1.395	1.9
Recirculation ratio..	2.7	1.63	0.00	1.33	0.80	0.00	1.33	0.80	0.00	.....	.....
Mgad. to filter.....	14.7	11.0	4.0	16.2	17.1	10.2	16.2	17.1	10.2	.....	.....
Ppm. 5 Day B.O.D.											
Raw	282	343	347	259	71	63	259	71	63	203	212.7
Creamery	547	290	256	.....	.....	.....	.....	.....	.....	.....	.....
Primary effluent...	183	220	230	.....	.....	51	.....	.....	51	.....	.....
To each filter including recir. ...	124	133	223	101	62	.....	101	62	.....	.....	.....
Final effluent	45.9	67.5	116	38	25	23	45	23	27	94.4	51.5
Lb. B.O.D. to Filters**											
Raw sewage basis.	125.6*	129.5*	119.4*	437	165	155	437	165	155	2360	3370
Recir. deducted prim. effluent ...	94.4*	95.3*	91.7*	300	156	126	300	156	126	.....	.....
To filter including recirculation	171	139	.....	394	201	.....	394	201	.....	.....	.....
Final effluent	17.8	26.7	44.4	64	58	56	76	54	67	1098	817
Lb. B.O.D. Applied per Cu. Yd. Filter Media											
Raw sewage basis.	0.586*	0.64*	0.554*	1.22	0.46	0.43	1.22	0.46	0.43	1.58	1.97
Prim. effl. recir. deducted	0.627*	0.635*	0.612*	0.84	0.43	0.35	0.84	0.43	0.35	.....	.....
To filter including recirculation	1.14	0.924	0.612	1.09	0.557	.....	1.09	0.557	.....	.....	.....
Percentage B.O.D. Removal											
By filters, based on prim. effl. recir. excluded	81.2*	72.9*	51.8*	79.5	62.2	55.6	74.2	65.5	42.1	.....	.....
By filters including recirculation	89.5	80.7	51.8	83.4	78.0	.....	80.7	73.0	.....	.....	.....
By entire plant, raw sewage basis	85.5	79.9	62.5	85.3	64.8	63.8	82.6	67.2	75.2	53.5	75.8

*This includes cheese waste introduced following primary clarifier but ahead of recirculation.
**Calculated from data given in Walton's original thesis.
***The flow is split between two filters in parallel.
[1]Army Bases I and VIII are the same as Posts I and VIII referred to by Kessler[1].
[4]Data by Walton.

TABLE VII

Army Base III

Effect of Hand Controlled Recirculation On Plant Results
Single Stage Aero-filters

Prior to November, 1943, the recirculation, which was introduced into the flow following the primary clarifier, was hand controlled. The control was made automatic during November, 1943.

	Oct., '41[1] to Mar., '42	1943 Aug.	Sept.	Oct.	Nov.	Dec. Avg.	Dec. Max.**	1944 Jan. Avg.	Jan. Max.**	Feb. Avg.	Feb. Max.**
Raw Sewage Avg. mgd.	3.35	2.75	2.66	2.39	2.15	2.03	2.03	2.14	2.29	2.12	2.98
Ppm. B.O.D.											
Raw Sewage	207	288	308	270	274	284	346	300	358	218	347
Prim. effluent		132	135	126	149	151	168	138	137	107	182
First stage—Final effluent	46	82	85	61	46	38	46	33	32	29	42
Pounds of B.O.D.											
Raw Sewage	5790	6610	6840	5390	4910	4820	6600	5350	6850	3860	8610
Prim. effluent		3030	3000	2515	2670	2560	3200	2460	2620	1890	4510
First stage—Final effluent	1285	1880	1890	1215	825	644	877	589	612	513	1040
Lb. B.O.D. applied per cu. yd. of media											
Raw sewage basis	2.90	3.3	3.42	2.69	2.45	2.41	3.3	2.67	3.42	1.93	4.3
Prim. effl. basis, does not include recircul.		1.51	1.50	1.26	1.34	1.33	1.60	1.23	1.31	.945	2.25
Percentage B.O.D. Reduc.											
By prim. clarifier		54.0	56.0	53.2	45.6	46.8	51.3	54.0	61.8	51.0	47.5
By filter, of load applied, prim. effl.		37.8	37.0	51.5	69.4	74.8	72.8	76.2	76.7	72.9	76.9
By entire plant	77.9	71.6	72.5	77.5	83.1	86.6	86.6	89.0	90.9	86.8	87.9
D.O. Ppm.											
Raw Sewage		0.6	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0
First stage—Final effluent		0.3	0.8	1.7	3.3	4.7	3.2	4.3	4.2	4.1	2.8
N. as nitrates in final effluent, ppm.	..	..	..	..	0.6	0.8	..	1.7	..	5.7	..

Recirculation was used in sufficient amounts to maintain a mini mum flow to the filters of 3.1 mgd.
[1]Kessler's data.
**Max. daily B.O.D. load for the month.

is a tendency to use too low an operating head on the distributor arms. When a head of 18 to 24 inches is provided for maximum flows the fixed orifices on the distributor will not provide proper distribution for minimum flows, which are often about half of the maximum. Sacrificing correct operating heads is a costly procedure considering the initial plant cost and the resulting loss of filter efficiencies.

Removal of Final Clarifier Sludge

Large final clarifiers without sludge scraper mechanisms should never be used following high-capacity filters. It is next to impossible to keep the sludge properly removed from large non-mechanized clarifiers. The sludge should be removed from the final clarifier several times each 24 hours. Frequent automatic removal, of course, is preferable.

Lack of Filter Ventilation

Underdrains are sometimes too small to provide free air passage. One-half of the capacity of the channels, at maximum flows, should be used for air. Full block tile or its equivalent is recommended.

Effect of the pH on Filter Efficiencies

Roetman[12] has pointed out that trickling filter efficiencies are impaired if the pH of the applied sewage is much greater than 8.0. Low pH values also reduce filter efficiency.

Filter Media

Small filter rock was once considered essential to provide the maximum of surface area, but it has been found that large media provide more available surface area since the filters are less liable to clog or choke. Either a special tile medium as shown in the accompanying cuts may be used in the first stage, or rock media ranging from 2½ in. to 4 in. in diameter with flats eliminated. Actual tests have shown that this large rock does a fine job.

The special tile media which are in use at River Falls, Wis., Detroit Lakes, Lakefield, Owatonna, and several other Minnesota installations perform well. At Detroit Lakes, River Falls and Lakefield fine screens are used ahead of the filters, instead of primary clarifiers. The saving in the cost of a fine screen over a primary clarifier normally more than offsets the difference between the cost of tile and rock. One important

TABLE VIII

Mason, Michigan

Effect of a bad supernatant upon the plant results

Two single stage Aero-filters in parallel using motor driven disc distributors
Monthly average results composited from 9 A.M. to 4 P.M. when no recirculation is used

Month 1943	Temperatures Air	Temperatures Sewage	Avg. Mgd. Raw	Mgad. 24 Hrs.	Ppm. B.O.D. Raw	Ppm. B.O.D. Prim. Effl.	Ppm. B.O.D. Final Effl.	Lb. B.O.D. Raw	Lb. B.O.D. Prim. Effl.	Lb. B.O.D. Final Effl.	Lb. Applied, Prim. Effl. Basis Per Cu. Yd.	Lb. Applied, Prim. Effl. Basis Per Acre Ft.	Percentage B.O.D. Reduction By Primary	Percentage B.O.D. Reduction By Filter	Percentage B.O.D. Reduction Overall
June	72	64	.673	20.8	139	60	17	780	337	95.5	0.803	1295	51.8	71.3	82.8
July	72	67	.650	20.1	117	73	14	634	396	75.6	0.945	1520	37.6	81.0	88.0
Aug.	69	68	.539	16.6	106	65	14	477	293	62.9	0.699	1125	38.7	78.5	86.9
Sept.	60	67	.469	14.5	125	97	29	488	378	113	0.910	1450	22.4	70.2	76.8
Oct.	48	63	.398	12.3	134	92	28	445	306	92	0.730	1175	31.3	69.6	78.0
Nov.	35	62	.431	13.3	149	96	46	536	345	165	0.825	1325	35.5	52.1	69.1
Dec.	25	57	.457	14.1	179	109	47	682	415	179	0.992	1595	39.1	56.9	73.8
1944															
Jan.	27	54	.469	14.5	210	152	57	821	595	222	1.420	2290	27.6	69.0	72.8
Feb.	25	55	.525	16.3	107	100	43	468	438	188	1.045	1685	6.5	52.3	59.7
Mar.	29	53	.676	20.8	139	76	36	782	428	203	1.020	1645	45.3	52.7	75.2
April	41	52	.701	21.7	149	69	31	872	404	181	0.965	1555	53.5	55.1	79.0
May	60	59	.639	19.7	163	102	37	869	542	197	1.295	2080	37.4	63.8	77.3
June	70	64	.613	18.9	101	62	18	516	317	92	0.757	1217	38.6	71.2	82.3

Note: This plant uses an unheated converted Imhoff tank as a digester and returns a bad supernatant to the front of the plant. The small stream into which the effluent discharges normally carries in excess of 6 ppm. of oxygen below the plant discharges.

TABLE IX

Army Base A, Located in a Cold Climate

Effect of mineral oil contamination on high capacity filter results
Two single stage uncovered Aero-filters operating in parallel using disc distributors

Year		1943			1944		
Month	Jan.-Feb.*	Sept.*	Jan.**	Feb.**	Mar.**	April**
No. 24 hr. composites	Two mos.	5	8	9	9	9
Mgd.						
Raw	.444	.519	.499	.582	.541	.579
Prim. effl.	.444	.519	.499	.582	.541	.579
Final effl.	.444	.519	.499	.582	.541	.579
Mgad. to each filter	13.7	16.0	15.4	18.0	16.7	17.9
Ppm. B.O.D.						
Raw	384	230	275	298	263	272
Prim. effl.	278	143	212	205	180	188
Final effl.	118	56.6	48	53	46	47
Lb. of B.O.D.						
Raw	1420	995	1145	1450	1190	1315
Prim. effl.	1035	619	880	1000	814	907
Final effl.	436	245	200	257	208	227
Lb. of B.O.D. Applied per Cu. Yd. of Rock						
Raw sewage basis	3.39	2.37	2.74	3.46	2.75	3.14
Prim. clarifier effluent exclusive of recirculation	2.46	1.47	2.09	2.38	1.94	2.16
Percentage B.O.D. Reduction						
By primary clarifier	27.1	37.8	23.1	31.0	31.6	31.0
By filter, of applied load	57.8*	60.4*	77.2**	74.3**	74.5**	75.0**
By entire plant	69.2*	75.5*	82.5**	82.4**	82.4**	82.8**

*Heavy mineral oil contamination.
**Light mineral oil contamination.
NOTE: Due to the heavy flow of raw sewage, very little recirculation is used and then only at night. The return is made following the primary clarifier.

advantage of the tile medium is that it eliminates the clogging troubles so often encountered when undersized rock is used. Moreover, tile permits a free passage of air through the filter. Tests made jointly by the U. S. Public Health Service and the Minnesota State Board of Health at Detroit Lakes, Minn.,[13] where there is a two stage plant using an Aero-filter in the first stage with a tile medium and which employs rain-drop application *without any recirculation* are shown in Table X. The Aero-filter is 51 ft. in diameter by 6 ft. deep and contains 454 cu. yds. of media (.282 acre feet).

A fine screen is used instead of a primary clarifier. The fine screen effluent flows to a wet well into which also discharges supernatant from the sludge storage tank. This combined liquor is pumped to the first stage filter.

When rock is used, in order to make sure that all small rock is eliminated, it should be rescreened on the job and the use of bulldozers for leveling prohibited. A filter with good rock is far cheaper in the long run than a filter with undersized media. It is a costly procedure to remove the rock for rescreening. In one high-capacity filter installation the rock was removed and rescreened, which resulted in 60 per cent of the rock being discarded as being smaller than the recommended minimum size of 2½ in. in diameter for first stage filters.

Filter Depths

The depth of the filter should vary with the strength of the sewage to be treated, unless increased recirculation is employed to offset the shorter period of contact through a shallow filter. Depths of 9 or 10 ft. might prove more efficient than 5 to 8 ft. for very strong wastes. It would not be surprising if a 12 ft. depth operating on an applied B.O.D. of 400 ppm. would give better results than a 6 or 7 ft. depth and having the same total quantity of filter media. More clogging, however, would doubtless take place with a rock depth of 12 ft. Also, plant hydraulics usually are not suited for extreme depths.

The Chicago Sanitary District ran a comparative test on a single stage Aero-filter 8 ft. deep and two filters each 3 ft. deep in series, using high momentary rates. Table XI gives the averages for the total period of operation from December, 1936, to December, 1937, inclusive. It should be noted that both plants were operated on the same Imhoff effluent at approximately 28 mgad. to each plant. The pounds of B.O.D. applied to the filters have been computed from the mgad. by this author. The 8 ft. depth was much more efficient than the two 3 ft. depths operated in series. The two stage plant was not operated during July.

The 5 ft. filter depth at Army Base C (Table III, Part I), operating on a strong waste and heavily loaded, gives reductions to the left of loading curve A of Fig. 2 (Part I).

TABLE X

Aero-filter Using Special Tile Media at Detroit Lakes, Minn.

Dates of Tests	1944 7/31	8/1	8/2
Mgd.			
Fine screen effluent	.441	.428	.465
Supernatant	.00314	.00262	.00315
Total to filter	.44414	.43862	.46815
Recirculation	None	None	None
Ppm. B.O.D.			
Fine screen effluent to wet well	394	237	297
Supernatant to wet well	139	247	300
First stage effluent	43	25	51
Lb. of B.O.D.			
To first stage filter	1468	852	1125
First stage effluent	161	90	200
Lb. B.O.D. Applied to Filter			
Per cu. yd. of tile media	3.23	1.87	2.48
Per acre foot	5200	3020	4080
Percentage B.O.D. removal by filter and intermediate clarifier (converted Imhoff), exclusive of removal by the fine screen*	89	90.1	84.0

*Larson reports that approximately 12.2 per cent of the raw sewage B.O.D. was removed by the fine screen.

TABLE XI

High Rate Filters at Chicago

	Aero-filter	
Dia. of filters, ft.	20	15
Number of filters	1	2†
Depth of each filter, ft.	8	3
Total cu. yds. of filter rock	93.1	39.4
Mgad. to filters, Imhoff effl.	27.5	28.8
Recirculation ratio	None*	2.16
Total Mgad. to filters	27.5	91.0
Mgd. to filters, Imhoff effluent calculated	.198	.1165
Ppm. B.O.D. to filters, Imhoff effluent	72.3	72.3
Lb. of B.O.D. to filters, Imhoff effl.	119.5	70.4
Lb. of B.O.D. Applied		
Per sq. ft. of area	.38	.398
Per acre foot	2070	2890
Per cu. yd. of rock	1.285	1.79
Lb. of B.O.D. removed per acre ft.	1186	964
Percentage of B.O.D. removed of load applied	57.2	33.3

*No recirculation was used for 75 per cent of the test period and less than 0.3 ratio for the remaining 25 per cent of the time.
†Two stage.

Tile Filter Media Installed at Chatfield, Minn.

Either this filter should have been deeper or the recirculation increased for such a strong waste. A single stage Aero-filter operating at Orrville, Ohio, on about the same strength of sewage and the same loading as at Army Base C gives percentage B.O.D. removals to the right of the loading curve of Fig. 2 without any recirculation. The Orrville filter is 9 ft. deep.

If a relatively shallow filter will permit gravity flow instead of pumping, it might be economical to increase the quantity of recirculation and reduce the filter depth. The shallowest Aero-filter constructed to date has been 4 ft. It is used on a very strong canning waste with heavy parallel recirculation.

Walton[4] concluded that a filter depth of 6 ft. would accomplish as much as a bed 8 ft. deep. Perhaps he failed to recognize that an applied loading up to 2 pounds of B.O.D. (settled sewage basis) per cubic yard of media in single stage Aero-filter operation seems to give a constant percentage of B.O.D. reduction. In his work he figured the filter load to include the recirculated B.O.D.

If there is sufficient rock in a 6 ft. depth of filter to handle the pounds of B.O.D., there seems to be little advantage in using an 8 ft. depth with an applied strength of 100 to 150 ppm. It is not reasonable, however, to expect the same reduction through a 4 or 6 ft. filter depth that could be accomplished by an 8 or 9 ft. depth using the same amount of filter media when treating a strong waste without increasing recirculation.

A recent test at the Dalmornock Sewage Works[15] showed that an enclosed filter 52 ft. in diameter and having a filter bed depth of 18 ft. gave B.O.D. removals per cubic yard greater than another filter of 7.5 acres with a 6 ft. bed depth. The enclosed filter used forced draft ventilation.

Suspended Solids

The subject of suspended solids has been intentionally omitted because of the length of the items covered. In general, however, the ppm. suspended solids in a settled high-capacity filter effluent are usually of about the same magnitude as the ppm. B.O.D.

(In Table XII, the descriptive information is given on the several filter installations referred to in this paper.)

Conclusions

6. Excessive oil and grease in the sewage passing to a filter cause adverse results.

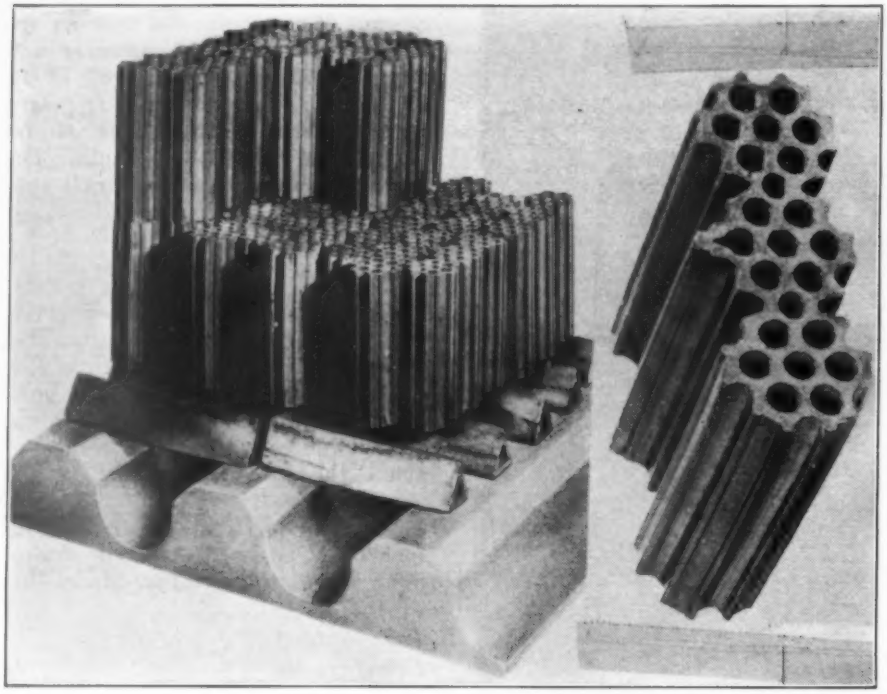
7. The return of a bad supernatant from the digester through the plant is detrimental to efficient filter operation.

TABLE XII

	Number of filters in parallel	Diameter each filter, ft.	Depth of each filter, ft.	Cu. yds. rock each filter	Total cu. yds. of rock	Type of distributor	Kind of sewage application used on filter	Plant location, warm or cold climate	Housed or unhoused filter units	Type of filter media	Method of recirculation
Army Base I	1	80	8	1490	1490	4 AR	F	Warm	U.H.	Rock	A
Army Base III	2	70	7	1000	2000	YBC	RD	Warm	U.H.	Rock	A
Army Base VIII	2	70	6	855	1710	6 AR	F	Warm	U.H.	Rock	A
Army Base A	2	30	8	210	420	Disc	RD	Cold	U.H.	Rock	A
Army Base B	4	73	7	1085	4340	YBC	RD	Cold	U.H.	Rock	A
Army Base C	1	33	5	159	159	Disc	RD	Cold	U.H.	Rock	A
Carlyle, Ill.	1	27	8	169	169	Disc	RD	Cold	U.H.	Rock	C
Detroit Lakes, Minn..	1	51	6	454	454	YBC	RD	Cold	H.	Tile	None
Glenwood City, Wis...	1	25	8	149	149	3 AR	F	Cold	H.	Rock	C
Lakefield, Minn.	1	25	7	131	131	YBC	RD	Cold	H.	Tile	B
Lake Mills, Iowa.....	1	22	8	113	113	Disc	RD	Cold	H.	Rock	C
Lubbock, Texas	2	78	8	1416	2832	YBC	RD	Warm	U.H.	Rock	A
Mason, Mich.	2	30	8	210	420	Disc	RD	Cold	U.H.	Slag	A
		58	7	685						Tile	
Owatonna, Minn.	2	55	6	528		8 AC	RD	Cold	H.	Rock	A
Paris, Ill.	1	61	6.5	703	703	YBC	RD	Cold	U.H.	Rock	C
River Falls, Wis.....	1	25	8	149	149	6 AC	RD	Cold	H.	Tile	None
Spartanburg, S. C. ...	1	84	8	1641	1641	YBC	RD	Warm	U.H.	Rock	A
Webster City, Iowa...	2	40	7.75	360	720	8 AR	F	Cold	U.H.	Rock	C

AR—Arms.
YBC—Multiple arm Y branched with centrifugal nozzles.
AC—Multiple arms, centrifugal nozzles.
F—Film spray application.
RD—Rain-drop application.
H.—Housed.
U.H.—Unhoused.
Method of recirculation—See Fig. 1.
Types of sewage handled by the various municipal filter installations referred to above.

Carlyle, Ill.	Domestic and heavy creamery.
Detroit Lakes, Minn.	Domestic and creamery.
Glenwood City, Wis.	Domestic and creamery, with some cheese waste.
Lakefield, Minn.	Domestic and creamery plus vegetable canning in summer.
Lake Mills, Iowa	Domestic and creamery plus corn canning in summer.
Mason, Mich.	Domestic and large volume of waste from a pharmaceutical milk products company.
Owatonna, Minn.	Domestic, creamery, heavy vegetable canning wastes for about 6 months per year, and a potato dehydrating plant in operation since 1942.
Paris, Ill.	Storm, domestic and poultry packing.
River Falls, Wis.	Domestic, creamery and brewery.
Spartanburg, S. C.	Domestic, industrial and army cantonment.
Webster City, Iowa	Domestic and poultry packing.



Tile Filter Media and Underdrain Arrangement

8. The media in high-capacity filters should be large and free of fines in order to provide good voids for the excess sludge to pass through. A special tile media may be used in conjunction with a fine screen in lieu of a primary clarifier. The tile which is adaptable to rain-drop application of the sewage seems to produce better B.O.D. removals than rock. This improved removal is no doubt due to the presence of an abundance of air and the elimination of any excess sludge accumulation in the filter.

9. When a trickling filter fails to provide B.O.D. reduction efficiencies at least equal to those represented by Figs. 2, 3, 4 and 5 herein, the cause can normally be traced to error in either design or operation rather than to any inability on the part of the filter to do its job.

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[1]L. H. Kessler and John T. Norgaard, "Sewage Treatment at Army Posts," *Sewage Works Journal*, Vol. 14, No. 4, pages 757-783, July, 1942.

[2]J. A. Montgomery, "A Discussion of High-Capacity Trickling Filters, with Special Reference to Aero-filters," *Sewage Works Journal*, Vol. XIII, No. 5, September, 1941.

[3]Frank A. Marsten, "High Rate Biological Sewage Treatment—A Discussion," *Sewage Works Journal*, Vol. 16, page 34, January, 1944.

[4]Graham Walton and John Wilson, "High Daily Rate Trickling Filter Performance," Ph. D. Thesis, University of Wisconsin, March, 1943.

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[6]A. J. Fisher, "The Present Status of Bio-filtration," *Water Works and Sewerage*, page 905, September, 1941.

[7]B. F. Hatch, "Sewage Treatment at Military Installations," *Sewage Works Journal*, Vol. 16, page 839, September, 1943.

[8]Herbert Wagenhals, "Sewage Treatment in the United States," United States Public Health Service, Bulletin 132, July, 1923.

[9]Childs and Schroepfer, "Trickling Filter Loadings," *Civil Engineering*, Vol. 15, pages 1391-1393, 1931.

[10]J. A. Montgomery, "Aero-Filter Results Predictions and Performances," *Sewage Works Engineering*, page 553, Nov., 1942.

[11]James H. Edmondson and Stanley R. Goodrich, "The Cyclo-Nitrifying Filter," *Surveyor* 102, pages 533-534, 539-541, December, 1943.

[12]E. T. Roetman, "Viscose Rayon Manufacturing Wastes and Their Treatment," *Water Works and Sewerage*, page 295, August, 1944.

[13]Winston C. Larson, "Modernization of the Sewage Treatment Plant at Detroit Lakes, Minnesota," page 19, *Public Works*, February, 1945.

[14]T. W. Herrick, "High Rate Filters at Chicago," *Sewage Works Journal*, page 276, March, 1938.

[15]A. Hunter and T. Cockburn, "Operation of an Enclosed Aerated Filter at Dalmarnock Sewage Works." Abstract in *Sewage Works Journal*, page 648, May, 1945.

S. C. Water and Sewage Works Short School

April 8-10 at Clemson

The annual Short Course for Water and Sewage Works Operators as given by the S.C. Water and Sewage Works Assn., has been scheduled for April 8, 9, and 10 at Clemson College, S.C.

No. Carolina Surface Water Analyses

From time to time the U. S. Dept. of Interior, Geological Survey, issues bulletins on the chemical characteristics of surface waters. One of the most recent issues is that on the *Chemical Character of Surface Waters of North Carolina*, 1943-44. Prepared by William L. Lamar in cooperation with the North Carolina Dept. of Conservation and Development, this report is obtainable without cost from that department, P. O. Box 2719, Raleigh, N. C.

"Bill" Allen Moved Up

William A. (Bill) Allen, until recently Supt. of the Tri-Cities Sewage Treatment Works at Pasadena, Calif., has been appointed Administrative Assistant to the City Manager of Pasadena.

One of Mr. Allen's first assignments in his new position is that of promoting and organizing a new County Sanitation District (No. 16 of the several Sanitation Districts of Los Angeles County). His other chief immediate work is that of promoting and expediting a housing program for Pasadena and environs.

"Bill" Allen has for a number of years been a leader in sewage works activities on the West Coast. He is a past-president of the Calif. Sewage Works Assn. and has just filled a three year term on the Board of Directors of the National Sewage Works Federation, representing the California group.

We congratulate the City Manager of Pasadena for having recognized the abilities of "Bill" Allen, who is so well qualified for the higher administrative position to which he has been appointed.

W. J. Barber of Omaha Dies

Longtime Asst. Mgr. Utilities

Willis J. Barber, Asst. Gen. Mgr. of the Metropolitan Utilities Distribution in Omaha, Neb., for forty-five years passed away on Feb. 11. Mr. Barber was a member of the American Water Works Assn., and active in the Missouri Valley Section since he joined the Association in 1938.

MEETINGS SCHEDULED:

Apr. 8-10—NIAGARA FALLS, ONTARIO (General Brock Hotel)
Canadian Section A.W.W.A. Sec'y, A. E. Berry, Director, Ontario Dept. of Health, Parliament Bldgs., Toronto 2, Ontario, Can.

Apr. 8-10—CLEMSON, S. C. (Clemson College)
South Carolina Water & Sewage Works Ass'n. Sec'y-Treas., D. F. Frick, 418 State Office Bldg., Columbia, S. C.

Apr. 11-12—BUTTE, MONT. (Finlen Hotel)
Montana Sewage Works Association. (Annual Meeting). Sec'y-Treas., H. B. Foote, Director, Div. San. Eng., State Dept. of Health, Helena, Mont.

Apr. 12-13—BUTTE, MONT. (Finlen Hotel)
Montana Section A.W.W.A. Sec'y, H. B. Foote, Director, Div. San. Eng., State Dept. of Health, Helena, Mont.

Apr. 15-17—FAYETTEVILLE, ARK. (Engineering Bldg.)
Arkansas Water and Sewage Conference. Sec'y, Harrison Hale, University of Arkansas, Fayetteville, Ark.

Apr. 18—BOSTON, MASS. (Statler Hotel)
New England Water Works Association. (Monthly Meeting). Sec'y, W. C. Conroy, 609 Statler Bldg., Boston, Mass.

May 6-10—ST. LOUIS, MO. (Exhibits & Technical Meetings in Auditorium). (Accommodations in 12 Hotels)
American Water Works Conference. (Annual Meeting). Executive Secretary, Harry E. Jordan, 500 Fifth Ave., New York 18, N. Y.

May 16—BRIDGEPORT, CONN.
New England Water Works Association. (Monthly Meeting). Sec'y, W. C. Conroy, 609 Statler Bldg., Boston, Mass.

May 16-17—BALTIMORE, MD. (Hotel Lord Baltimore)
Maryland-Delaware Water & Sewage Ass'n. Sec'y, Miss E. V. Gipe, 2411 N. Charles St., Baltimore, Md.

May 16-18—BALTIMORE, MD. (Lord Baltimore Hotel)
Maryland-Delaware Water & Sewage Works Assn., Secy. Miss E. V. Gipe, Maryland Dept. of Health, Baltimore, Md.

May 17—GREENWICH, CONN. (Pickwick Arms)
New England Sewage Works Association. Sec'y-Treas., Walter E. Merrill, State Dept. of Health, 511A State House, Boston, Mass.

May 23-24—CORVALIS, ORE. (Gearhart Hotel)
Pacific Northwest Section A.W.W.A. Sec'y, Fred Merryfield, Oregon State College, Corvalis, Ore.

May 24-25—UTICA, N. Y. (Hotel Hamilton)
New York State Sewage Works Association. Sec'y-Treas., A. S. Bedell, State Dept. of Health, Albany, N. Y.

June 9-11—MONTEREY, CALIF.
California Sewage Works Association. Sec'y-Treas., Harold H. Jeffrey, 112 City Hall, Sacramento 14, Calif.

June 13-14—LAFAYETTE, IND. (Purdue University)
Central States Sewage Works Assn. Sec'y-Treas., J. C. Mackin, Route 4, Madison, Wis.

June 19—MANCHESTER, VT. (Equinox House)
New England Water Works Association. (Annual Outing). Sec'y, W. C. Conroy, 609 Statler Bldg., Boston, Mass.

June 20-21—AKRON, O. (Mayflower Hotel)
Ohio Conference on Sewage Treatment. Sec'y-Treas., L. B. Barnes, 441 So. Prospect St., Bowling Green, Ohio.

Aug. 26-28—STATE COLLEGE, PENNA.
Pennsylvania Water Works Operators Association. Sec'y-Treas., I. M. Glace, 1001 North Front St., Harrisburg, Pa.

Oct. 7-9—TORONTO, CANADA (Royal York Hotel)
Federation of Sewage Works Assns. Exec.-Sec'y, W. H. Wisely, 625 Illinois Bldg., Champaign, Ill.

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Write for Bulletin 5-8

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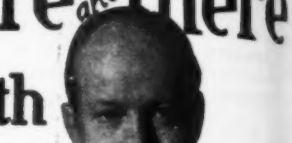


Recent news releases from the Water and Sewage Works Mfrs. indicate that the next Fed. Sew. Wks. Assn. meeting will adopt the Club Room idea of entertainment, and that the AWWA recommends that the members of WSWMA consider the idea for future meetings of the AWWA Sections.

About this idea it might be well to quote Leonard Thompson, Pres., AWWA, who said, in his "Review of Developments in Water Supply" in our Jan. issue, "To this section (Canadian) we are also indebted for the creation of the water works club room idea, which appears to be gaining in popularity wherever it is tried."

This columnist first encountered the idea at the Canadian Institute of Sewage & Sanitation meeting in Oct. 1943, and in the Nov. 1943 issue of "Here & There" set forth to praise the scheme. - - - It has some drawbacks and does need *ample* room for it to function properly, but if given a fair trial, methinks its advantages will be apparent.

* * *

I'm a bit sorry to see George Schroepfer desert the operating field for the professorial robes. Just when George was beginning to make such wonderful copy as Milt Rosen's understudy at conventions, he had to "straighten up and fly right."

* * *

Funny how one's memory plays him false at times: The N. J. Sect. held its Winter Meeting in New Brunswick and had a panel of experts to answer questions on water conservation by meters and metering. Presided over by Sam (II) Newkirk, the panel consisted of Shaw (Pitometer) Cole, Jack (Neptune) Faulks, Dick (Meter Box) Ford, Dave (Builders-Providence) Purdie, and Bill (Worthington-Gamon) Flanders.

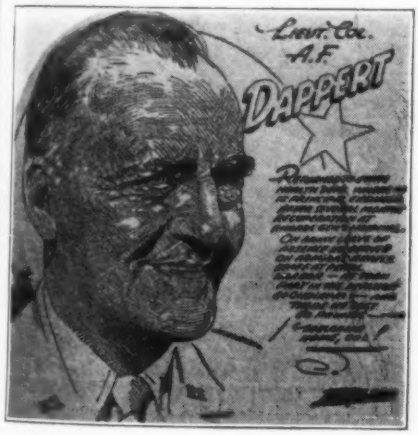
When Roswell Roper (that reforestation expert of E. Orange) asked if there was any information published on how to choose the size of a house meter, not one of the panel knew that in the Ref. and Data Sect. of the 1945 June issue of *Water Works & Sewerage* (as this magazine was called then) there appeared on p. R-117 an article on "Water Requirements for Various Uses and Fixtures." In the same issue on p. R-111 is Marsden Smith's article on "Standards for Water Service," and on p. R-19 there appeared Stephen Taylor's article on "Regulating Water Piping Within Buildings."

No, sir! Not one of those experts remembered that these three articles deal with or are related to Roper's question, and—damit—neither did I!

By the way, the Ref. and Data issue this year will be in the April issue. - - - Remember, it takes *at least* the current and the past two issues to give you a complete set of these Ref. and Data articles and information. - - - This year again there will be a five year index consolidated in the 1946 issue to cover not only the three issues you need but also any previous articles that have not been used in the past three years.

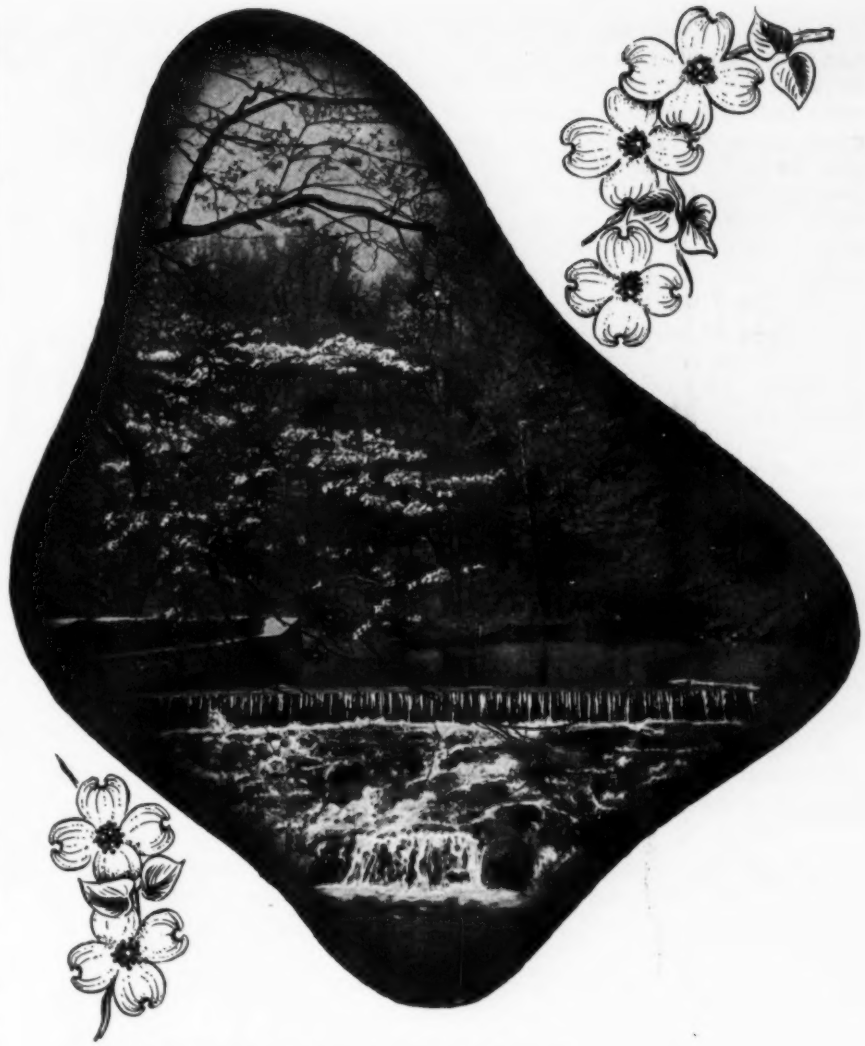
* * *

I cut this cartoon out of Jerry Costello's "Weekly News Theater" in the Feb. 9 issue of the Albany, N. Y., *The Knickerbocker News*. I liked it and thought you might, too; hope Mr. Costello doesn't mind.



* * *

When the atomic bomb was announced, it was a sure bet that everyone who could would claim some part of the project. Lest we forget, it couldn't have been done without plenty of water. When you know that the temperature of the Columbia River is said to have been raised by 0.5° C., it must have taken a lot of water.



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It happened in 1922. It was the month of July; it was hot and it was in a little town in Iowa just 36 miles from Des Moines on a narrow gauge railroad. A wreck on the narrow gauge had delayed a young man's arrival for a council meeting until late that afternoon, by which time court was being held in the city council chambers and the council couldn't meet until night.

Night came and it was still so hot that when the councilmen met, someone moved that they adjourn to the bandstand in the park, which they did. There beneath one 25 watt bulb, while mosquitoes provided an obligato, the young man read from a paper, extolling the advantages of the equipment he wanted to sell.

When he finished, the silence was broken only by the slap at a mosquito that had tarried too long on an ankle or neck. Then came a voice from the darkness, "I move we sign the order and go home."

O. T. Birkness had sold his first chlorinator for W & T just 29 days after he joined the company.

* * *

Can you believe that Joe Reny of Portland, Me., once wrote to a hydrant manufacturer for some hydrant pots, and received a reply asking, "What is a hydrant pot?"

* * *

Hmmm! - - - Knowing our Skipper's penchant for indoor as well as outdoor gardening, the following cartoon from *This Week*, sent anonymously to L. H. E., was no surprise.

On second thought, did the sender intend to suggest that the editor of *W. & S. W.* has hobbies extending beyond the realm of pure horticulture? Hmmm!

* * *

Small World. On a recent trip to Buffalo I fell into conversation, as one often does, with the man in the next seat. Turned out to be the man who was my "laundry woman" when I lived in Buffalo—Mr. Dates, of the Laundry Service.

What was even a bigger surprise was the fact that he was familiar with *Water and Sewage Works* (*Water Works & Sewerage* it was then). Said he saw it on his brother-in-law's desk. His brother-in-law—a fellow named Ed. Stapely—you know, the Dean of Engineering at Oklahoma A & M—Small World?

* * *

R. C. Beckett said it. At the 4-States meeting (Baltimore), R. C. Beckett, Ch. Engr. of the Del. Health Dept., and then the chairman of the 4-States Sect., opened the meeting with the comment that "from indications of the previous evening, this section will soon be known as the 4-States Bridge Club." Yes, my friend, Mike Glace was there!

* * *

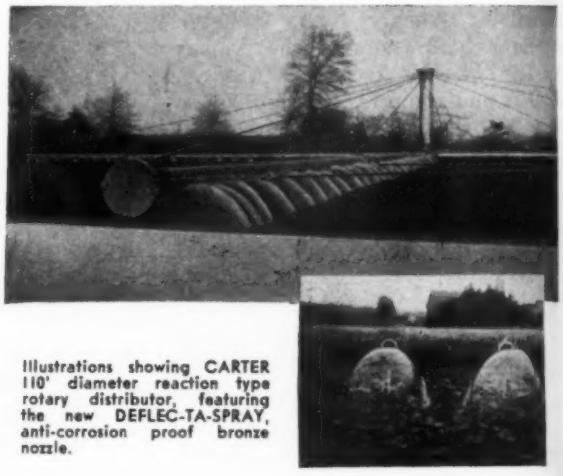
It was Paul Weir, of Atlanta, who, when he heard about ozone being used to kill odors in sludge storage tanks, remarked, "A new dentifrice for sewage plant halitosis, eh?"

ROTARY

CARTER

DISTRIBUTORS

WRITE FOR BULLETIN NO. 4401



Illustrations showing CARTER 110' diameter reaction type rotary distributor, featuring the new DEFLEC-TA-SPRAY, anti-corrosion proof bronze nozzle.

Mr. Consulting Engineer:—

If your design problem demands a high removal of B.O.D. and suspended solids; stabilized efficiencies during severe temperatures, plus practical control of the filter fly problem, we suggest you investigate the CARTER reaction type rotary distributor mechanism. Complete information on our unit, with details of the new leveling flange, which permits column alignment without disassembly of arms are described in our Bulletin 4401.

RALPH B. CARTER CO.

HACKENSACK, NEW JERSEY

New York Office: 53 Park Pl., New York 7, N. Y.

[Overflow from the main section]

Surplus Property

How and Where to Get It.

Perhaps that title presumes too much. In order to tell you how to get surplus property, one would have to know a thousand changing rules, be a mind reader, and foretell the future as well. Governmental regulations and procedures being what they are, the best that one can do perhaps is to tell where to go to find out about how to get surplus property.

There are eleven regional offices, each of which is responsible for the sale of surplus property located in the states served by that particular office. Information on surplus property must be obtained from these regional offices.

Municipally owned utilities and governmental agencies in general may obtain surplus property at 40 per cent discount from fair value, but the purchaser must certify that he does not intend to buy the material for resale, but only for his own existing needs.

The address, territory served, and the telephone number of each of the eleven regional offices is given below. Make your needs known to the office nearest you and get on their mailing lists for announcements of materials and equipment.

No. 1.—600 Washington St., Boston 11, Mass. Phone: Lafayette 7500. Connecticut, Maine, Massachusetts, New Hampshire, Vermont, Rhode Island.

No. 2.—Sixty-first Floor, Empire State Bldg., New York 1, N. Y. Phone: Murray Hill 3-6800. New York, New Jersey.

No. 3.—Lafayette Building, 5th and Chestnut Sts., Philadelphia, Pa. Phone Walnut 4400. District of Columbia, Delaware, Pennsylvania, Maryland, Virginia.

No. 4.—704 Race Street, Cincinnati 2, Ohio. Phone: Parkway 7160. Indiana, Kentucky, Ohio, West Virginia.

No. 5.—209 LaSalle St., Chicago 4, Ill. Phone: Franklin 9430. Illinois, Michigan, North Dakota, South Dakota, Minnesota, Wisconsin.

"VIC" VICTAULIC SAYS...
"You can pass a dollar through a pinhole!"
"You don't have to be a magician either... just unwise... for it happens every time you have a leaking pipe joint! There are dollars passing through these leaks... and they might be your dollars!
"This chart shows how much leaks can cost you...
SIZE OF OPENING
AIR 100 Lbs. Pressure
Cu. Ft. Wasted Per Month
Cost at 10c Per M
GASOLINE 15 Lbs. Pressure
Gal. Wasted Per Month
Cost at 4c Per Gal.
WATER 40 Lbs. Pressure
Gal. Wasted Per Month
Cost at 15½c Per M
3/8" 9,979,200 $997.92 423,000 $16,920.00 682,400 $108.00
1/4" 4,449,600 444.96 188,000 7,520.00 307,700 48.00
1/8" 1,114,560 111.46 47,100 1,884.00 76,900 12.00
1/16" 278,640 27.86 11,800 472.00 19,200 3.00
"Don't gamble on your pipe couplings and fittings. Buy assured leak-tightness, flexibility and strength, together with speedy assembly and minimum maintenance costs... buy Victaulic Couplings and Victaulic Full-Flow Elbows, Tees and other Fittings – the choice of industries large and small."
Write for new Victaulic Catalog and Engineering Manual
VICTAULIC COMPANY OF AMERICA
30 Rockefeller Plaza, New York 20, N. Y.
Victaulic, Inc., 727 W. 7th St., Los Angeles 14, Calif.
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For export ouside U. S. and Canada
PIPEco Couplings and Fittings
Pipe Couplings, Inc.
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Have you considered Victaulic for your piping requirements?
Sizes – ¾" through 60"
SELF-ALIGNING PIPE COUPLINGS
VICTAULIC
EFFICIENT FULL-FLOW FITTINGS
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Gravity Water Filters as designed and installed by The Norwood Engineering Company are completely unified. Norwood specifications do not stop with filter beds and piping, but include operating floors and efficiently planned buildings to house the equipment.

Each job is individual—carefully worked out in every detail. Norwood Filters remove pollution and foreign matter from water, and may be combined with aeration and automatic chemical treatment to correct objectionable odors, color, organic or mineral content.

Consulting, municipal or industrial engineers are invited to write for further information on any water treatment problem.

W-3

New buildings housing Norwood Filters and Operating Floor at American Brass Co., Ansonia, Conn.

The NORWOOD
ENGINEERING COMPANY
25 N. Maple St.
Florence, Mass.

The Best For Your Money
NORWOOD FILTERS
In The Long Run

No. 6—105 Pryor St., N. E., Atlanta 3, Ga. Phone: Walnut 1301. Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee.

No. 7.—Post Office Box 1407, Fort Worth 1, Tex. Phone: 2-1287. Louisiana, Texas, Arkansas, Oklahoma.

No. 8—2605 Walnut St., Kansas City 8, Mo. Phone: Harrison 0375. Iowa, Kansas, Missouri, Nebraska.

No. 9.—728 Fifteenth St., Denver 2, Colo. Phone Keystone 4151. New Mexico, Utah, Colorado, Wyoming.

No. 10.—30 Van Ness Ave., San Francisco 2, Calif. Phone: Underhill 1922. California, Arizona, Nevada.

No. 11.—2005 Fifth Ave., Seattle 1, Wash. Phone: Maine 2782. Oregon, Montana, Idaho, Washington.

North Jersey Water Supply

Attractively printed and illustrated, the Report on Water Supply of the North Jersey Water Supply Commission sets forth the history of this Commission, its problems and its need for increased supply.

The report of this Commission, of which Charles H. Capen, Jr., is Chief Engineer, carefully considers the problem of water supply deficiency, the needs for water, and the program for increasing the supply. The Wanaque River, now serving as the source of supply, was probably the first cooperative water project. The whole project is described and its operation since 1930 discussed.

The program for increasing available water supply is divided into two parts. The first is for a reasonable enlargement of existing supplies. This would include the expansion of the Wanaque system by diversion of flood waters from the Ramapo River at Pompton Lakes, thus increasing the yield of the Wanaque up to about 110 million gallons per day, as compared with the present maximum of 85 million gallons per day which can be counted on in the dry period.

The second part of the program is a suggestion to create a Dock Watch Hollow reservoir. The report also considers the opposition from residents in Somerset County and other projects as well. After careful consideration, the report proposes the use of the Ramapo River and the Dock Watch Hollow reservoir. Design planning is now under progress and it is hoped that some financial arrangements can be made for the construction of the project. Certainly the Commission is to be complimented on its presentation of information pertinent to the subject of the new supply.

Useful Kink for Applying Glue*

To be sure, there is nothing better than a brush for applying glue to large surfaces and to areas that are easily reached.

However, my eyes opened wide not long ago when I saw a workman doing a gluing job in a different way. He was applying glue without the usual brush. He squirted the glue out of an ordinary oil can.

My interest was aroused, of course, and I began asking questions. I learned that with an oil can it is possible to place the glue exactly where wanted, in small or large doses, in grooves, in deep holes and in spots that are not get-at-able with an ordinary brush.

I was informed that it is easier and better to do a job in this way, particularly where you want to place

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.

the glue on the bottom of a groove or hole without touching the sides on the way down. The can of glue should be kept warm at all times. This may be done by placing the can in warm water while it is not being used.

A Special Slide Rule for Hydraulics of Pipe Culverts

A special slide rule for solving the hydraulics of pipe culverts or short pipe lines, and especially useful in design problems, has been developed by Dr. F. T. Mavis, Head of Department of Civil Engineering, Carnegie Institute of Technology, Pittsburgh, Pa.

This rule, on the rear side of which are printed five typical examples involving its application, is 10¼ in. long and 3¼ in. wide. With its use the hydraulic properties of culverts and short pipe lines from 18 to 96 in. diameter and with slopes from 0.01 to 4.0 per cent can be easily and rapidly determined.

M. W. Loving, long connected with the Am. Concrete Pipe Assn. as engineer and secretary, and now a consulting engineer in his own right with offices at 228 N. La Salle St., Chicago, has had a hand in the development of this slide rule. He states that with this computing rule the most economic design of culverts and short pipe lines compatible with safety can be selected.

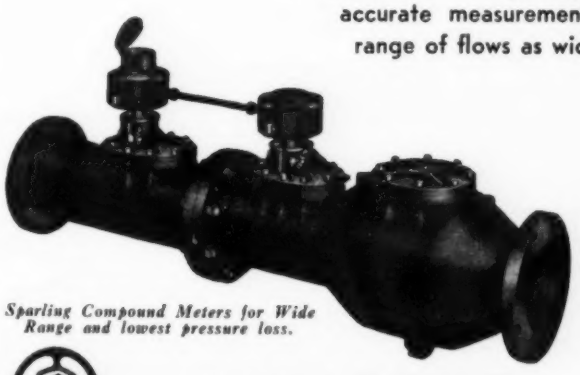
These slide rules have been produced for free distribution by manufacturers of concrete pipe. If the reader wishes one, it may be obtained from some concrete pipe manufacturers, the names of which we do not have. However, a request addressed to M. W. Loving, Consultant, 228 N. La Salle St., Chicago 1, Ill., will suffice to secure one of these useful Mavis Hydraulic Slide Rules.

Serving LONG BEACH Since 1924

In the first year this West Coast City used Sparling Main-Line Meters, the Water Department installed twenty-two Sparlings—sizes 12-inch and 16-inch. Service and satisfaction is indicated by the installation to date of seventy-eight

SPARLING MAIN-LINE METERS

These meters, 4-inch to 30-inch, measure the flow from wells, to and from reservoirs, service to government establishments, use of Colorado River water, and so on. The list includes nine Sparling Compounds, where accurate measurement must extend over a range of flows as wide as 1 to 75.



Sparling Compound Meters for Wide Range and lowest pressure loss.

Our Bulletin 308 is yours upon request.

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Manufacturer of Water Measuring Equipment

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CHICAGO 16.....3104 South Michigan Ave. 101 Park Avenue.....NEW YORK 17
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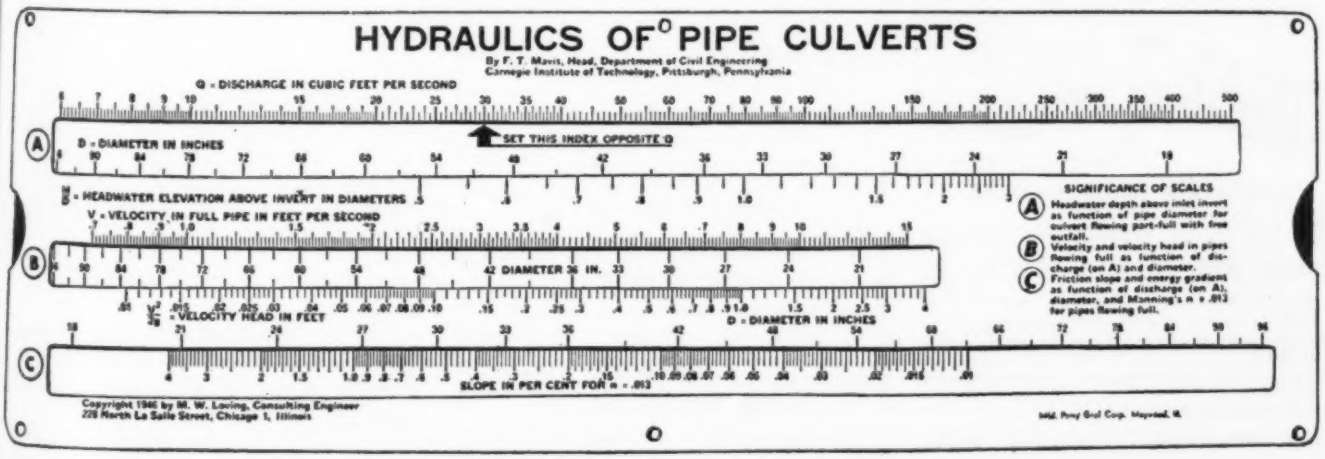
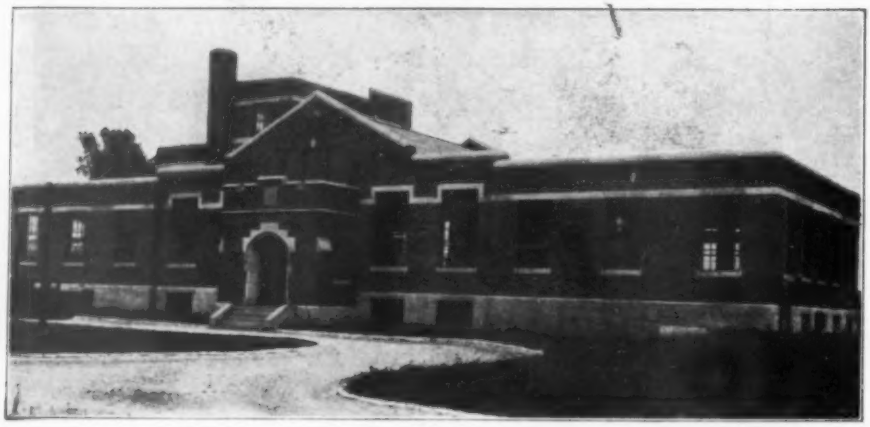

HYDRAULICS OF PIPE CULVERTS
By F. T. Mavis, Head, Department of Civil Engineering
Carnegie Institute of Technology, Pittsburgh, Pennsylvania
Q - DISCHARGE IN CUBIC FEET PER SECOND
SET THIS INDEX OPPOSITE Q
D - DIAMETER IN INCHES
HW/D - HEADWATER ELEVATION ABOVE INVERT IN DIAMETERS
V - VELOCITY IN FULL PIPE IN FEET PER SECOND
DIAMETER 36 IN.
V²/2g - VELOCITY HEAD IN FEET
D - DIAMETER IN INCHES
SLOPE IN PER CENT FOR n = .013
SIGNIFICANCE OF SCALES
A Headwater depth above inlet invert as function of pipe diameter for culvert flowing part-full with free outfall.
B Velocity and velocity head in pipes flowing full as function of discharge (on A) and diameter.
C Friction slope and energy gradient as function of discharge (on A), diameter, and Manning's n = .013 for pipes flowing full.
Copyright 1946 by M. W. Loving, Consulting Engineer
228 North La Salle Street, Chicago 1, Illinois

CASE HISTORY No. 7



Water Softening Plant, Fremont, Ohio

A SOFTENING PLANT

Wm. H. Schneider, Supt. & Chemist, Water Filtration Plant, Fremont, Ohio.

"The City of Fremont, Ohio, located on the Sandusky River in North Central Ohio, in the year of 1928 designed and built a water softening plant to handle 3,000,000 gallons of water per day. The plant was planned to soften and purify the very flashy Sandusky river water, with a turbidity reaching 3,000 p.p.m. and hardness up to 660 p.p.m.

"The plant was of a conventional design, employing Lime and Soda Ash for softening and Alum for coagulation. Trouble was encountered in forming a satisfactory floc in the colder months, especially with high turbidities. As the city grew and the demand increased, it was necessary to find a remedy for this condition, and after running laboratory tests indications were that an iron salt would give better results. An old feeder was converted so as to make it possible to run a plant scale test, using FERRI-FLOC.

"The conclusions reached from this plant test prompted our purchasing new feeding equipment suitable for feeding FERRI-FLOC. As a result of this change, we have secured a more satisfactory finished water throughout the entire year.

"Our thanks to the Technical Staff of the Tennessee Corporation for their assistance in solving our problem."

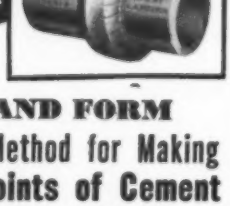
(Signed) Wm. H. Schneider.

TENNESSEE CORPORATION

Manufacturers of Ferri-Floc

Atlanta, Georgia — Lockland, Ohio

WESTON



GASKET AND FORM

The Perfected Method for Making Sewer Pipe Joints of Cement

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

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REPAIR and SAVE

Water Meter Measuring Chambers

with the

MEMPHIS SLOT INSERT

of stainless steel with new bronze thrust roller.

For further information and *free* 5/8" samples

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METER SPECIALTY CO.

1332 N. Seventh St. Memphis, Tenn.

Water and Sewage Patents

(OF RECENT ISSUE)

WATER PATENTS

Liquid Treating Apparatus and Process. Walter H. Green (to Infilco, Inc., Chicago, Ill.); U. S. 2,391,697; Dec. 25, 1945 (Appl. 5-26-43). Upflow coagulation and slurry basin with rotating agitator, and overflow into an adjacent filter, with means for washing filter and returning wash water to slurry chamber.

Proportioning Pump. Walter J. Hughes (to Infilco, Inc., Chicago, Ill.); U. S. 2,391,703; Dec. 25, 1945; (Appl. 3-6-43). A chemical proportioning pump.

Filter. Robert J. Koupal (to Infilco, Inc., Chicago, Ill.); U. S. 2,391,716; Dec. 25, 1945; (Appl. 5-7-43). A filter plant comprising several units, separate yet adapted to be joined one to another wall to wall.

Liquid Treating Apparatus. Frank D. Prager (to Infilco, Inc., Chicago, Ill.); U. S. 2,391,738; Dec. 25, 1945; (Appl. 12-8-41). A combination upflow coagulation and slurry basin surrounded by a settling basin wherein the products of reaction are settled out leaving the clear liquid to overflow.

Self Priming Pump. Richard D. Campbell (to Allis-Chalmers Mfg. Co., Milwaukee, Wis.); U. S. 2,391,769; Dec. 25, 1945; (Appl. 5-14-43). A self-priming centrifugal pump.

Method of Conditioning Boiler Water. Lewis O. Gunderson (to Dearborn Chemical Co., Chicago, Ill.); U. S. 2,391,895; Jan. 1, 1946; (Appl. 3-18-46). Method of conditioning water for steam generation using colloidal silica and hydroxides of heavy metals.

Water Softening Material and Method of Preparing Same. Svein Dahl-Rode, New York; U. S. 2,391,951; Jan. 1, 1946 (Appl. 12-9-41). Method of preparing coffee particles to be used as ion exchange material.

Valve. Isaac N. Reed (to Wedge-plug Valve Co., New Orleans, La.); U. S. 2,392,880; Jan. 15, 1946; (Appl. 11-15-43). A plug valve.

Lubricated Shutoff Butterfly Valve. David W. Hopkins, Philadelphia, Pa.; U. S. 2,392,922; Jan. 15, 1946; (Appl. 11-31-43).

Method and Means for Conditioning Boiler Feed Water. Harold M. Wall, Houston, Texas; U. S. 2,393,-079; Jan. 15, 1946; (Appl. 11-30-43).

Coagulant Composition for Removal of Suspended Solids or Dissolved Material From Liquids. William Rudolfs and Harry W. Gehm (to Permutit Co., New York); U. S. 2,393,269; Jan. 22, 1946; (Appl. 10-2-41). A coagulant, for use in removing dissolved or suspended matter from liquids, comprising ferric chloride and gelatine in the proportion of 1 to 7 parts by weight of gelatine with 5 parts by weight of ferric chloride.

Destruction of Algae. Hoyt M. Corley (to Armour and Co., Chicago, Ill.); U. S. 2,393,293; Jan. 22, 1946; (Appl. 10-28-40). An algacide consisting of an aqueous solution of water soluble salt of a primary aliphatic amine, the hydrocarbon radical of which contains at least 12 carbon atoms.

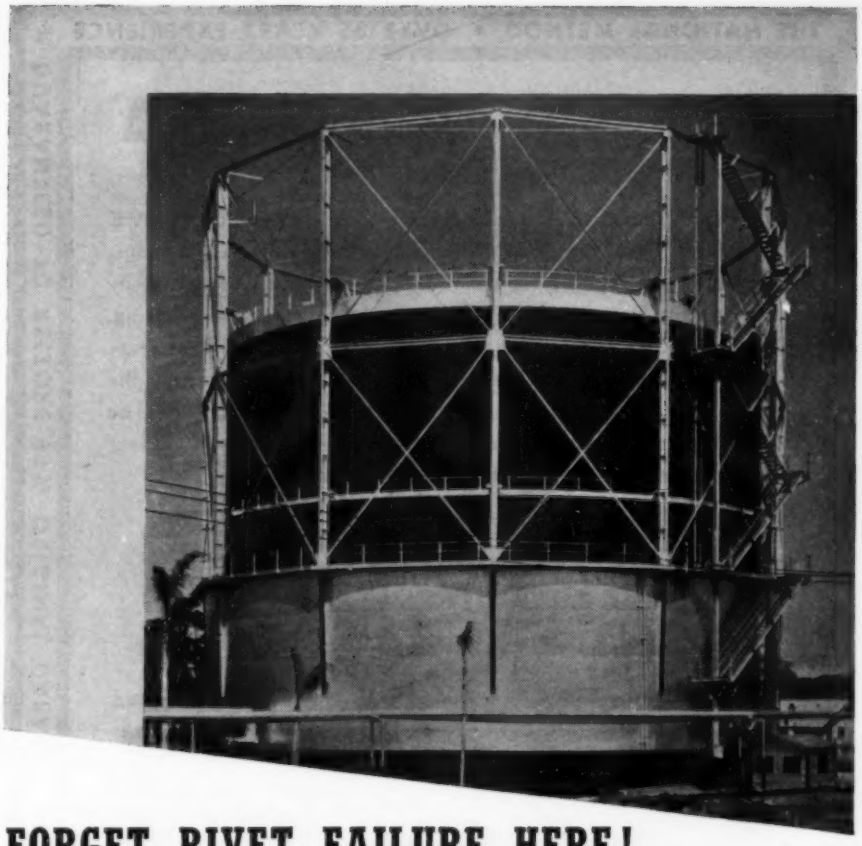
SEWAGE PATENTS

Liquid Clarification. Earl M. Kelly, Arthur M. Kavari, Robert P. Kite, Elliott J. Roberts, and David B. Sutherland (to The Dorr Co., New York, N. Y.); reissue U. S. 22,701; Dec. 4, 1945; (Appl. for reissue 8-28-45); (Original No. 2,324,-400, July 13, 1943). Process of removing suspended matter from liquid by subjecting the liquid to a slight vacuum in an enclosed system, whereby gases dissolved in the liquid are released and carry solid particles to the surface of the liquid where they are skimmed off.

Method and Apparatus for Treating Sewage. James D. Walker (to The American Well Works, Aurora, Ill.); U. S., 2,391,494; Dec. 25, 1945. Process for treating sewage which includes the steps of flowing the sewage in extensive contact with air through a trickling filter, settling the sewage, removing the settled sludge, and passing the liquid to activated sludge aeration tanks which are followed by settling tanks from which some of the settled activated sludge is returned to the aeration process.

Sewage Comminuting Apparatus. Walter J. Hughes (to Infilco, Inc., Chicago, Ill.); U. S. 2,391,704; Dec. 25, 1945. A sewage solids cutting and straining device comprising a semi-cylindrical grid adapted to be placed horizontally and longitudinally across an opening in the bottom of a sewage flow channel.

Process of Disposal of Sulfite Waste Liquor. Richard Gaines Tyler, Seattle, Wash.; U. S. 2,392,435; Jan. 8, 1946; (Appl. 1-25-43). Process for disposing of sulfite waste liquor derived from manufacture of pulp by calcium bisulfite digestion of wood. Waste treatment comprises passing the liquor from the digester



FORGET RIVET FAILURE HERE!

There *aren't* any rivets to fail in this Stacey Brothers All-Welded Panel Type Gas Holder.

That's one important advantage of this type of construction, a Stacey Brothers feature. There are others, too—greater strength, more efficient operation, less maintenance expense.

It's reasons like these that have influenced the choice of Stacey Brothers for tanks. The installation pictured is typical—a 500,000 cu. ft. All-Welded Panel Design Wet Seal Holder.

Our experience includes more than three hundred distinct types of tanks—any practical size or shape—with gas holders ranging in capacities from 100 cu. ft. up to 10,000,000. We fabricate as light as No. 16 gauge sheet metal, and up to three inches thick.

Whether your needs are standard—or unusual—there's a Stacey Brothers Holder, *custom built* to fit your requirements. No problem is too tough for us—or too routine. We'll take *complete* responsibility for design, manufacture and erection. That way you save both time and money. We make it our business to deliver dependable, economical holder capacity. May we submit our quotation and recommendations, based on your own specifications and drawings?

STACEY BROTHERS GAS CONSTRUCTION CO.
One of the Dresser Industries
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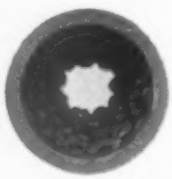
Stacey Brothers TANKS

★ THE NATIONAL METHOD • OVER 35 YEARS EXPERIENCE ★

SAVE For VICTORY

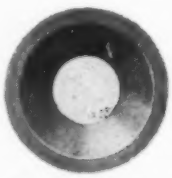
★ ★ ★

EVERYWHERE Americans are being asked to "SAVE FOR VICTORY." Water works superintendents, engineers and public officials can do more in this connection by investigating the National Method of water main cleaning. This method restores the carrying capacity of pipe to at least 95 per cent of that of new mains, thereby eliminating the necessity for purchase of new mains. Aside from this the National Method makes possible lower pumping costs, greater delivery, reduced insurance rates and clean water.



Before Cleaning

The NATIONAL METHOD



After Cleaning

★ GUARANTEED TO RESTORE 95% ORIGINAL CAPACITY ★

The National Water Main Cleaning Co.

50 Church St. Branches: New York 7

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P. O. Box 749, Mayaguez, Puerto Rico
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84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 3" TO 84"

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

through an acid resistant base exchanger to remove calcium, and thereafter reducing the water content and burning the residue to a smelt containing valuable sodium salts.

Combustible Gas Indicator. Moses G. Jacobson and Ralph E. Hartline (to Mine Safety Appliances Co., Pittsburgh, Pa.); U. S. 2,393,220; Jan. 15, 1946 (Appl. 11-4-38). Portable apparatus for selective testing of combustible gases with different ignition temperatures.

Method for Utilizing Iron Chloride Liquors. William Y. Agnew (to National Lead Co., New York, N. Y.); U. S. 2,393,582; Jan. 29, 1946 (Appl. 8-8-42). Process of electrolysis of ferric chloride liquor containing free hydrochloric acid.

Sludge Collecting Mechanism. James D. Walker (to American Well Works, Aurora, Ill.); U. S. 2,393,725; Jan. 29, 1946; (Appl. 10-22-43). Sludge collecting mechanism for rectangular settling tanks, including endless chain with flights.

Drying Apparatus. Charles W. Gordon (to combustion Engineering Co., Inc., New York); U. S. 2,393,766, Jan. 29, 1946; (Appl. 11-28-42). Flash drying system utilizing a source of heat, two cyclone collectors and means for delivering wet material into the system.

Sewage Treatment. James D. Walker (to The American Well Works, Aurora, Ill.); U. S. 2,394,413; Feb. 5, 1946; (Appl. 8-11-42). An activated sludge process employing two aeration steps in series with settling interposed between the aeration steps, and return of some of the final effluent to the raw sewage for diluting purposes, and to minimize shock loads.

Recovery of Waste Sulphuric Acid. James M. O'Shaughnessy (to National Lead Co., New York); U. S. 2,394,470; Feb. 5, 1946; (Appl. 6-8-44). A method for treatment of industrial liquor containing sulfuric acid.

Continuous Filter. Edwin Letts Oliver, Philip J. McGuire, James E. Slaughter, and Arthur W. Vettel (to

United Filters, Inc., Oakland, Cal., and The Permanente Metals Corp., Oakland, Cal.); U. S. 2,395,499; Feb. 26, 1946; (Appl. 10-8-43). A vacuum filter for filtering sludge and solid particles from suspension, employing vacuum to pick up cake and air to discharge it with taut strings to aid in the discharge of the cake.

MANUFACTURERS' and EQUIPMENT NEWS

Kerr Named V.P. In Charge Sales for Rockwell Mfg. Co.

A. J. Kerr, formerly General Sales Manager, has been elected Vice President of Sales of the Rockwell Manufacturing Co., Pittsburgh. Starting as District Manager of the

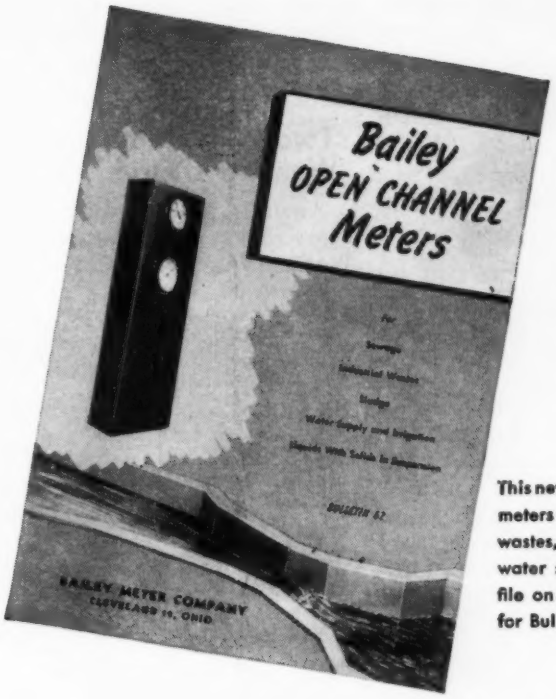
Tulsa office of the Pittsburgh Equitable Meter and Nordstrom Valve companies, which are now divisions of the Rockwell Manufacturing Co., Mr. Kerr progressed through the company until he was made General Sales Manager in 1944.

As Vice President of Sales of the Rockwell Manufacturing Co., Mr. Kerr will coordinate the marketing activities of all the various subsidiaries of the parent company, including Pittsburgh Equitable Meter Div., Nordstrom Valve Co., etc.

Oxygen Recorder

A new automatic continuous analyzer for indicating and recording the oxygen content of a gaseous mixture has been developed by the Bailey Meter Co. The instrument provides a graphic analysis almost instantaneously and is responsive to minute changes in oxygen content. A recorder operates on the basis of continuous sampling of gas mixed with a vaporized fuel and burned on a catalyst filament which reaches a temperature proportional to the oxygen content. The filament resistance is a function of temperature from which the apparatus may be calibrated in excess air, per cent oxygen, or other desired terms.

These oxygen records may be applied to all types of furnaces operating with oxidizing atmospheres thus permitting closer regulation of fuel-air ratios, especially where multiple fuels are used, or where the firing rate changes rapidly. By permitting closer regulation, increased economy and decreased furnace maintenance result. Not only will these oxygen recorders be applicable to the general types of oil, coal and gas furnaces and boilers in power production, but they should also find an application in drying and incin-



This new publication describing meters for sewage, industrial wastes, sludge and irrigation water should be part of your file on flow measurement. Ask for Bulletin 62.

FEATURES of BAILEY OPEN CHANNEL METERS

1. Low Cost
2. Easy to Install
3. Easy to Maintain
4. Retain Accuracy
5. Self-Cleaning
6. Adjustable Capacities
7. Indicate, Record and Integrate
8. Totalize Multiple Flows
9. Rate of Flow and Ratio Controls
10. Simple Chemical Feed Controls

MU21

BAILEY METER COMPANY

1029 IVANHOE ROAD • CLEVELAND 10, OHIO

Meters and Controls for Sewage and Water

VENTURI TUBES, FLUMES, WEIRS, NOZZLES, ORIFICES • DIRECT MECHANICAL AND REMOTELY LOCATED REGISTERS • AIR-OPERATED, ELECTRONIC AND ELECTRIC CONTROLS.

eration furnaces for sludge incineration.

Further information on this new oxygen recorder may be obtained from the Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, Ohio.

Improved High Test Calcium Hypochlorite

According to an announcement of the Columbia Chemical Div. of the Pittsburgh Plate Glass Co., an improved, high test calcium hypochlorite, containing a minimum of 70 per cent available chlorine, is now available under the trade name "Pittchlor." Previously the output of this material has been used for military service where it was used as a bleach, germicide and disinfectant. "Pittchlor" is being marketed by the Columbia Chemical Div. for its special advantages in the chlorination of water supplies of small daily outputs, as well as for emergency conditions, main sterilization, and for combating odor conditions around sewage treatment works and at pumping stations.

Literature on the uses of Pittchlor is now available from the Pittsburgh Plate Glass Co., Columbia Chemical Div., Fifth Ave. at Bellefield, Pittsburgh 13, Pa.

Two New Mathieson Mid-Western District Managers

According to a recent announcement from the Mathieson Alkali Works, Nelson F. Wilmot has been

Nelson F. Wilmot

Merle S. Clark

appointed Chicago District Sales Manager and Merle S. Clark appointed St. Louis District Sales Manager for the company. The St. Louis branch office is but newly opened in the Paul Brown Building.

Both Messrs. Wilmot and Clark joined Mathieson in 1931. The former attended Mass. Inst. of Technology, and the latter the University of Indiana.

Bailey Engineers Study New Developments in Measurement and Control

District branch office managers of the Bailey Meter Co. met recently in Cleveland at the company factory to study new developments in the company's line of meters and control.

Prominent among the new products was the line of electronic type instruments, including resistance thermometers, potentiometer pyrometers, oxygen and combustibles recorders, telemetering systems, compensating and calculating systems, all greatly simplified and rendered particularly suitable for industrial service by the use of electronics.

Also studied were new electronic type process controllers for temperature which are available for use with pneumatic, electric, or electronic control systems. The development of electronic devices for measuring

ONE OF YOUR SEWAGE PROBLEMS IS GREASE
GET FULL DETAILS TODAY
CLIP THIS AD!

Grease in sewage is a menace...it clogs pipe lines, disrupts service, interferes with proper sludge development. Learn all about grease and its control through easily installed, positive acting Josam Grease Interceptors. Send for copy of "Grease Interception". The most complete authority on the subject today. Includes "Selection Chart" for various types of installations. Gives installation details. Clip this ad, fill out coupon and mail today!

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320 Empire Building • Cleveland 14, Ohio
JOSAM-PACIFIC CO., San Francisco, California
West Coast Distributors
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JOSAM MFG. CO., 320 Empire Bldg., Cleveland, Ohio
Please send me a free copy of "GREASE INTERCEPTION".
NAME.....
TITLE.....
ADDRESS.....
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FILL OUT NOW MAIL TODAY!

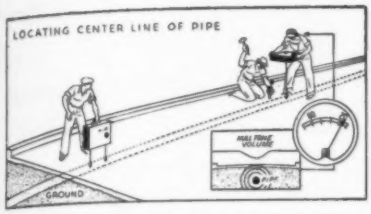
HAVE A LOOK—"through the OPERATOR'S EYE"

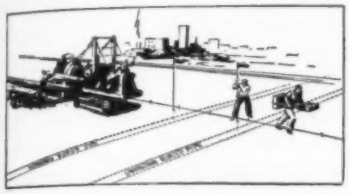
New hi-powered models bore 2½ to 14½ inch hole—FAST!
Write for Engineering Data and Illustrated Booklet

A LOOK through the HYDRAUGER Sights tells you precisely where your pipe-run will emerge 150-200 feet away! The HYDRAUGER then bores and reams the hole, just over pipe-size, right to the TARGET. The HYDRAUGER method is quick, sure, and least costly. With a HYDRAUGER, traffic interference is reduced and unnecessary pavement cutting and ditching is avoided. No loss of pipe-strings like in ramming or jacking. Drills conglomerates and semi-hard formations. Operates on 90-pounds air-pressure, and uses sufficient water to flush back cuttings from the bit.

HYDRAUGER
HYDRAUGER CORPORATION, LTD.
116 NEW MONTGOMERY STREET
SAN FRANCISCO, CALIFORNIA

M-SCOPE





BURIED PIPE AND CABLE FINDER

16 PAGE BOOKLET FREE UPON REQUEST

FISHER RESEARCH LABORATORY

Palo Alto, California

ODOR and TASTE are health factors too...

The WATER SUPPLY that pleases nose and palate is an important contribution to community health — people drink more of it.

ESOTOO* is the answer to a simple, sure, and more economical method of controlling residual chlorine — especially in "break-point" chlorination.

ESOTOO* is the Ideal De-Chlorinator.

**ESOTOO is "Virginia's" Trade Name for Liquid Sulfur Dioxide.*

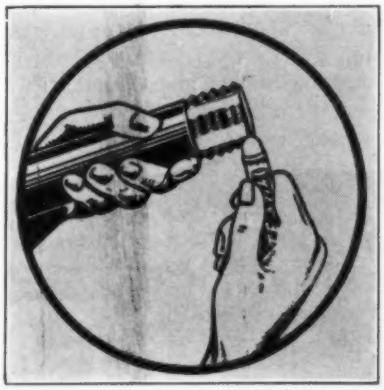
VIRGINIA SMELTING COMPANY

and recording is expected to be a boon to the field of water and sewage works where control of chemical feed and volumes of liquid handled are important factors in the operation of a plant.

More information on these new developments may be obtained by writing the Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio.

Threaded Pipe Joint Compound in Stick Form

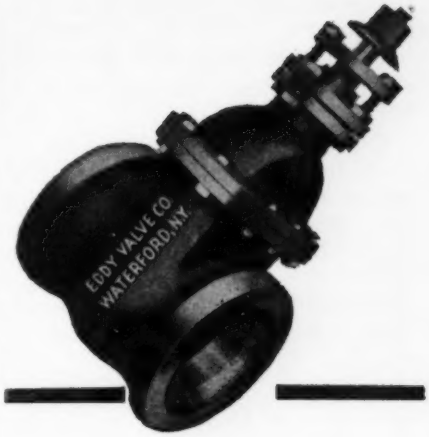
"Pipetite-Stik," a new pipe joint compound in handy, clean, easy-to-use stick form, is being offered by the Lake Chemical Co. of Chicago. The "Pipetite-Stik," which is encased in a convenient cardboard holder and may be carried in a pocket or tool kit, is a pipe joint compound which withstands gasoline, oil, butane, propane, freon, air, water, steam, acid, gas, brine, sulphur dioxide, etc.



All that is necessary is three or four strokes of the stick rubbed across the pipe threads, when the pipe is made up, the threads are lubricated and the pipe connection completely sealed. The joint compound will withstand vibration, temperature change, deflection, pressure, and prevents rusting; and pipes sealed with it are usually unjointed long after the first connection. The material contains no lead or other injurious ingredients. It may be obtained from the Lake Chemical Co., 607 N. Western Ave., Chicago 12, Ill.

Osborne Senior Operating V. P. of Westinghouse

L. E. Osborne, who joined Westinghouse at the age of 16 as a clerk in the tool room, was recently named senior operating Vice President of the Westinghouse Electric Corp. Mr.

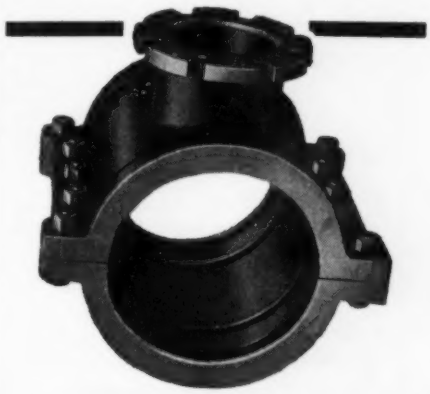


Eddy

TAPPING MACHINE VALVE

TAPPING MACHINE SLEEVE

FOR branch connections specify the Eddy Tapping Valve and Sleeve. These, when used with drilling or tapping machine, insure a trouble-free, water-tight connection. Iron body bronze mounted, tested to 300 lbs. pressure, recommended for anything up to 150 lbs. pressure.



EDDY FOR LONG SERVICE

EDDY VALVE COMPANY
WATERFORD, NEW YORK

Osborne's new responsibilities also include all subsidiary manufacturing companies as well as the District Mfg. and Repair Dept. and the Headquarters Mfg. Div.

During the war, Mr. Osborne was the directing head of the company's Steam Division at South Philadelphia, Pa., and the adjoining Merchant Marine Division. Mr. Osborne's rise through the company is typical of many American industrial leaders during the past 30 or 40 years.

C. L. Kennicott Dies

Inventor of Famed Water Softeners

C. L. Kennicott, the inventor of the Kennicott Water Softening Machine, and the founder of the Kennicott Water Softening Co. in 1899, died at the end of last year. Mr. Kennicott was probably the father of the lime-soda ash water softening treatment in this country, and prior to forming his own company was Chief Chemist of the Municipal Laboratory of Chicago. After leaving the Kennicott Co. in 1914 he joined the staff of the Permutit Co., where he was located until 1921, when he reentered the field as a consulting chemist.

"Flectrol" Remote Control

"Flectrol," a remote control device, provides fingertip remote control of speed when applied to commercial speed changers. The dial may be set instantaneously to any desired speed

ELECTROL CONTROL MOTOR
SPEED CHANGER
ELECTROL CONTROL UNIT
TYPICAL FLECTROL APPLICATION ON A CONTINUOUSLY VARIABLE SPEED TRANSMISSION

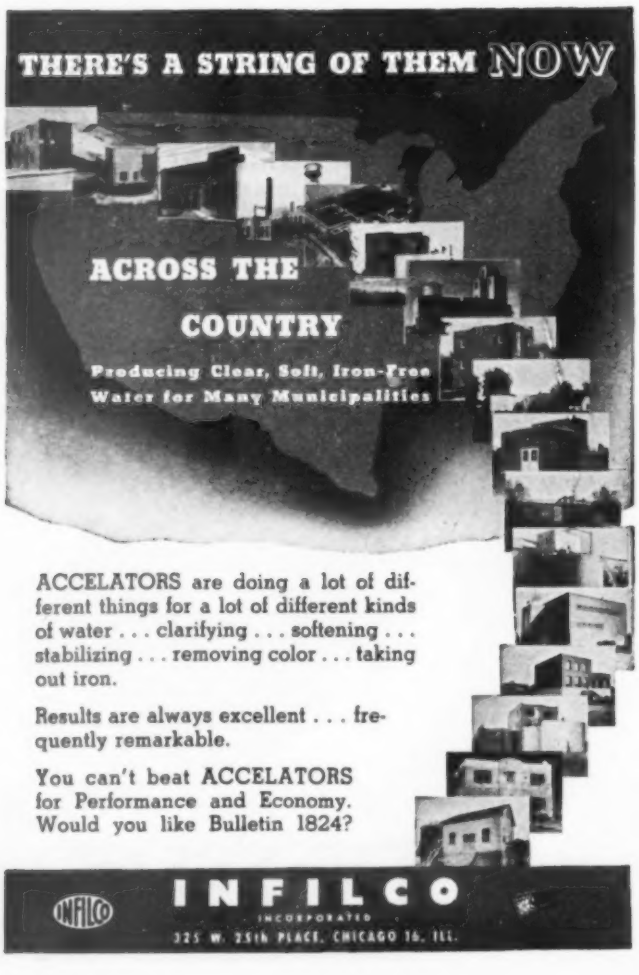
and the speed changer will follow as fast as the electric servo-motor can drive the speed adjusting screw. Exact speed setting is possible, the dial can be calibrated in rpm., ft. per min., gal. per hr., etc. Flectrol is simple, rugged, and compact. It is applicable to new or existing equipment of any type. It can be built in or added to motor operated valves, conveyors, etc.

Flectrol is a product of the Yardeney Laboratories, Inc., 105 Chambers St., New York 7, N. Y.

Water Main Sterilization Service Being Offered

The firm of Luther & Wood, suppliers of water and sewage works equipment, are now offering a water main sterilization service in the central eastern territory which the firm serves.

Luther & Wood explain that many communities do not have the equipment for performing the disinfection of new mains or repaired mains, nor do they have the personnel or laboratory facilities required to insure a thorough job of main disinfection. And, expecting a considerable amount of new mains and extensions to distribution pipe systems, this firm has provided itself with the required equipment, chemicals and know-how so that this special service may be offered to the smaller water utilities in particular and at a nominal cost.


THERE'S A STRING OF THEM NOW
ACROSS THE COUNTRY
Producing Clear, Soft, Iron-Free Water for Many Municipalities
ACCELATORS are doing a lot of different things for a lot of different kinds of water . . . clarifying . . . softening . . . stabilizing . . . removing color . . . taking out iron.
Results are always excellent . . . frequently remarkable.
You can't beat ACCELATORS for Performance and Economy. Would you like Bulletin 1824?
INFILCO
INCORPORATED
325 W. 25th PLACE, CHICAGO 16, ILL.

They Will PROVE to You How GOOD They Are
PUMPS "by Aurora"
No matter how exacting your requirements, there is a size and type of Aurora Centrifugal or Apco Turbine-Type Pump to handle it PERFECTLY. Products of experience. Built by exclusive makers of fine pumps.
Aurora Deep Well Turbines for all conditions—4" to 24"
Type AD Hor. Split Case, Two Stage Centrifugal
NSA Aurora Centrifugal Sump Pump
Type OD Hor. Split Case Double Suction Single Stage Centrifugal
Type G M C Close-Coupled Centrifugal
Apco Turbine-Type Pumps The simplest of all pumps. Ideal for small capacity, high head duties. Silent, compact and lasting.
Type GGU Side Suction Single Stage Centrifugal
APCO Horizontal Condensation Return Unit
APCO Single Stage Turbine-Type
Write for CONDENSED CATALOG M or See Our Catalog in SWEETS.
DISTRIBUTORS IN PRINCIPAL CITIES
AURORA Always PUMPS
AURORA PUMP COMPANY
68 Loucks Street, AURORA, ILLINOIS

HYDRO-TITE

HYDRO-TITE — the self-caulking joint compound that makes cast iron water pipe joints — strong — tight — flexible and everlasting. Used on thousands of miles of pipe with a record of more than 30 years without a failure.

FIBREX — The sanitary paper packing that is used like braided jute. Free from bacteria — treated with a water repellent — put up in 60 pound reels. 70 pounds of Fibrex takes the place of 100 pounds of braided jute.

HYDRAULIC DEVELOPMENT CORPORATION
50 Church St.
New York, N. Y.

DRY BRAIDED
Fibrex

STEEL FORMS for CONCRETE METER BOX TILES

You can make excellent meter box barrels at low cost with one of these steel forms. They are made in several sizes and lengths.

Let your post-war plans include making good use of one or more of these forms. Make a start now by asking for information.

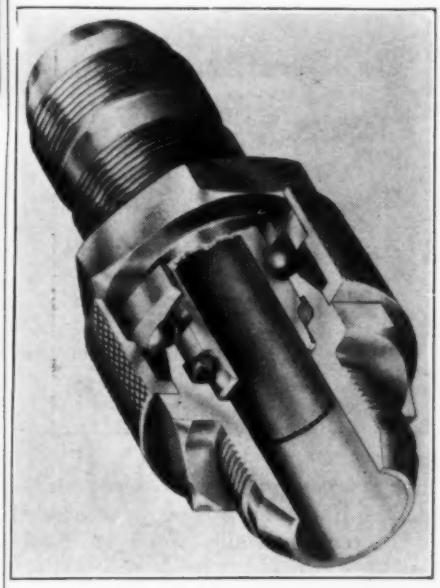
FORD
Meter Box Co.,
WABASH, INDIANA

Luther & Wood correctly point out that water main disinfection is not the simple job that it was earlier assumed to be; and unless done effectively the attempts are little more than a gesture.

If you are within a 200 mile radius of Washington and desire assistance in a contemplated main disinfection job, make inquiry of Luther & Wood, 310 Chandler Bldg., 1427 Eye St., N. W., Washington, D. C.

Quick Coupling for Pressure Lines

Designed for use on hoses and lines operating under pressure, a new Quick Coupling has been announced by the Roylyn Mechanical Laboratory of Los Angeles. This new coupling is particularly adapted for hydraulic and pneumatic lines and is based on the inclined plane and wheel principle employing but three major parts: cam ring, ball cage and nipple.



By rotating the cam collar steel balls are forced inward into a groove in the nipple forcing the halves together. The gasket retained in the ball cage provides a positive seal against dirt as well as being the separating spring force necessary to the operation of the lock.

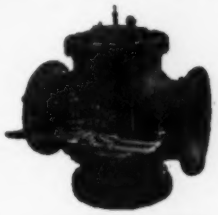
This Quick Coupling operates over a wide temperature range and wide pressure limits. Couplings are available in aluminum, brass, alloy or stainless steel.

Descriptive literature may be obtained from the Roylyn Mechanical Laboratory, 8928 Santa Monica Blvd., Los Angeles 45, Cal.

· 1879 ·
ROSS
AUTOMATIC VALVES

ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES

FLOAT VALVES • REDUCING AND REGULATING VALVES



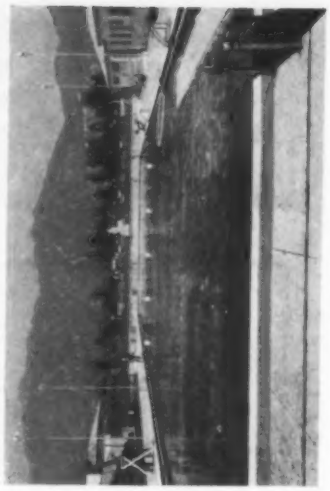
ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs, hydraulic control.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.
4. Can be equipped with electric and manual controls.

COMBINATION VALVE
This valve will permit flow in one or both directions acting as
1. Pressure Reducing and Relief Valve.
2. Pressure Reducing and Altitude Valve.
3. Relief and Altitude Valve.

REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

ROSS VALVE MFG. CO.
INCORPORATED
P. O. BOX 595, TROY, N. Y.

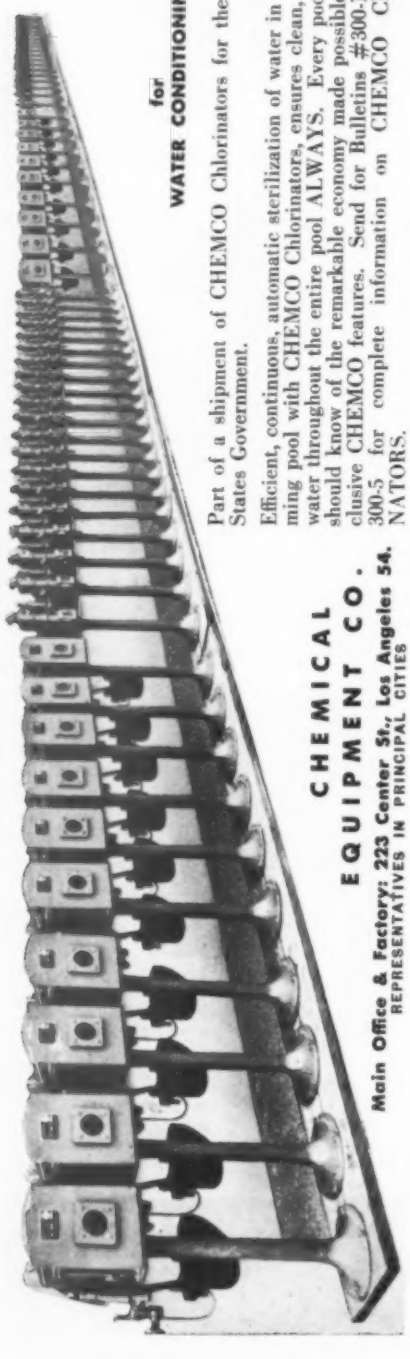
CHEMCO CHLORINATORS



for
WATER CONDITIONING

Part of a shipment of CHEMCO Chlorinators for the United States Government.

Efficient, continuous, automatic sterilization of water in a swimming pool with CHEMCO Chlorinators, ensures clean, healthy water throughout the entire pool ALWAYS. Every pool owner should know of the remarkable economy made possible by exclusive CHEMCO features. Send for Bulletins #300-1, 300-3, 300-5 for complete information on CHEMCO CHLORINATORS.



CHEMICAL EQUIPMENT CO.
Main Office & Factory: 223 Center St., Los Angeles 54.
REPRESENTATIVES IN PRINCIPAL CITIES

Stuart Halliday Joins Consolidated Diesel

Stuart E. Halliday, for the past nine years connected with the Novacal Chemical Co., as a salesman and sales manager, has joined Consolidated Diesel Electric Corp., New York, to supervise sales and advertising.

The Consolidated Diesel Electric Corp., manufacturers of electric generating sets, has erected a new building at 230 E. 8th St.,Mt. Vernon, N. Y., where the company moved on March 1.

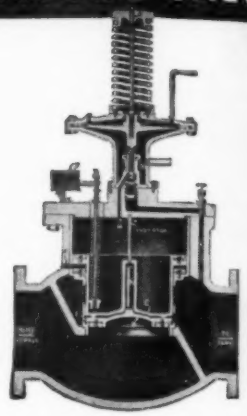
Cotoid Protective Coating

Developed by the Lithgow Corp., Chicago, Cotoid is a new thermoplastic synthetic resin coating which is resistant to acids, alkalies, chlorides, oils, brine, oxygen, gasoline and alcohol solutions. When dried either by air or force drying, Cotoid results in a tough, hard, elastic

finish which is tasteless and odorless. It has been found practicable for protecting walls, wood or steel structural work in food processing plants, wineries, breweries and paper mills. It can be used for coating the inside and outside surfaces of concrete, steel or wooden tanks used for corrosive solutions, brines and alkalies. With these characteristics it would appear to be applicable to chemical tanks in water and sewage plants as well as to coating on equipment submerged in sewage.

Packaged in 1, 5, and 10 gallon cans and 55 gallon drums, Cotoid, which may be applied by spraying, dipping, flowing or roller coating, is produced and sold by the Lithgow Corp., 333 W. 40th Place, Chicago 9, Ill. For further details and free technical service on the use of Cotoid, write the manufacturer.

AUTOMATIC "STOP-STARTER"
GOLDEN-ANDERSON
ALTITUDE VALVES



Eliminate all water surges and shock.

Installed where a single line is used for both supply and discharge, the valve will maintain a constant water level within 3" to 12" variation and by means of the "stop-starter" switch stops the pump as the valve closes.

Let GOLDEN-ANDERSON Engineers Solve your Flow Control Problems.

GA
GOLDEN-ANDERSON
VALVE Specialty Company

FOR BETTER
pH Control
and WATER TESTS
there is nothing like

NON-FADING
GLASS COLOR
STANDARDS

Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of the technique, and compactness of the apparatus are exclusive features of Hellige Comparators not found in any similar outfits.

WRITE FOR BULLETIN No. 602

HELLIGE
INCORPORATED
3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.
HEADQUARTERS FOR COLORIMETRIC APPARATUS

Dreier Now with American Well Works

Douglas E. Dreier, Senior Sanitary Engineer of the Illinois State Dept. of Health, Sanitary Engineering Div., has joined the staff of the American Well Works at Aurora. Dreier is well known in the midwest for his work in the Illinois Dept. of Health during the wartime period.

LITERATURE AND CATALOGS

MECHANICAL PROCESSING EQUIPMENT

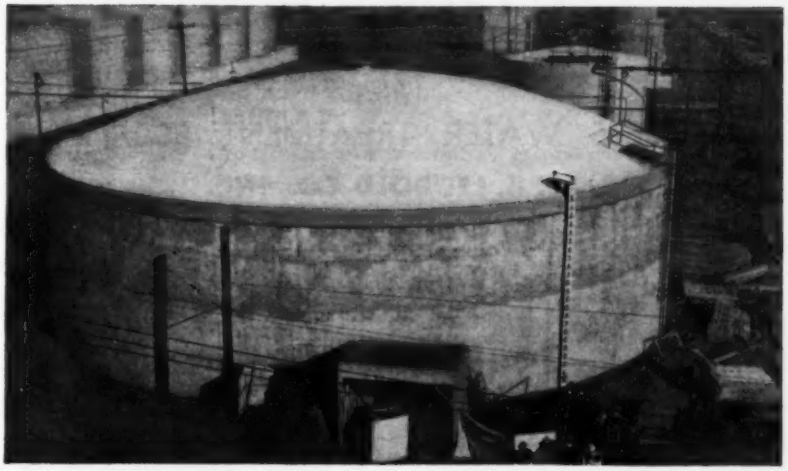
If you want to know what the Ralph B. Carter Co., manufactures in the way of **Mechanical Processing Equipment,** write for Bulletin 4505. This bulletin contains one page each describing twelve other bulletins issued by the company. Each page shows the equipment manufactured for particular use and gives the bulletin number. The various bulletins and equipment described are listed as follows: Bulletin No. 4501, Mechanical Mixing Equipment; No. 4504, Primary Clarifiers; No. 4401, Rotary Distributors; No. 4504, Final Clarifiers; No. 4502, Sludge Pumps; No. 4311, Digester; No. 4310, Centrifugal Pumps; No. 4312, Alternating Siphons; No. 4503, Contractor's Pumps; No. 4501, Paddle Aerators; Nos. 39 and 40, Stuart-Carter Flocculating Equipment. Bulletin No. 4505, describing these various other bulletins, or the individual bulletins themselves may be obtained by writing the Ralph B. Carter Co., Hackensack, N. J.

PHOTOGRAPHIC STUDY OF BADGER METER

A photographic study of the work done by the Badger Meter Mfg. Co. has been issued under the title of **All Out For War, All Set For Peace.** This photographic essay shows the work done by the company during the war and the work which its mechanics and machines do in making peace time products.

According to C. W. Wright, President of the Badger Meter Mfg. Co., this book has been produced as a tribute to Americans, and the

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.



PRE-STRESSED "GUNITE" WATER TANK

The water storage tank shown above was built by us of "GUNITE" in 1944. The wall and dome ring girder are pre-stressed. The dome roof is also "GUNITE." It is 90' in diameter and 25' deep, and is bottle tight.

We have built scores of similar pre-stressed tanks and stand-pipes for the storage of various liquids, and also pre-stressed silo for the dry storage of chemicals.

Our new bulletin C2300 describes this work and a great many other jobs. Write for your free copy today.

MANUFACTURERS OF THE "CEMENT GUN"

FIRST STEP TO IMPROVED EFFICIENCY

and Reduced Vacuum Filtration Costs.

Ferri-Cl3or
Ferric Chloride
The FAST Coagulant

THE MODERN COAGULANT

FERRIC CHLORIDE

INNIS, SPEIDEN & CO.
117 LIBERTY STREET • NEW YORK 6, N. Y.
BOSTON • CHICAGO • CINCINNATI • CLEVELAND • GLOVERSVILLE • PHILADELPHIA

Leopold

GLAZED FIRE CLAY TILE FILTER BOTTOM

Non-Corrosive—Permanent

DRY CHEMICAL FEEDERS

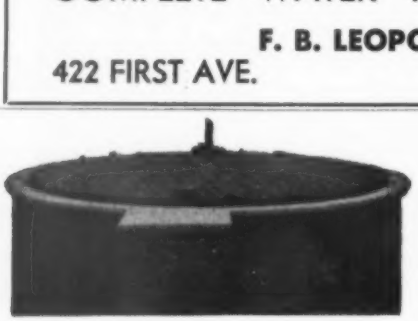
Accurate—Dependable

also

COMPLETE WATER TREATMENT EQUIPMENT

F. B. LEOPOLD CO., INC.

422 FIRST AVE. PITTSBURGH 19, PA.



Over 225 P. F. T. Floating Covers in War Service

The health of our fighting men and war workers is being safeguarded by modern sewage disposal plants. We are doing our part by delivering on time P.F.T. Floating Covers and other sewage treatment equipment.

The P.F.T. Floating Cover for single and stage digestion hastens the digestion process, and provides for utilizing the sewage gas to heat water for the digester tank.

Catalog No. 232 contains complete information, including specifications. Write for your copy.

P.F.T. PACIFIC FLUSH-TANK CO.
4241 Ravenswood Ave., Chicago, Ill.
New York Charlotte, N. C.

RODNEY HUNT

GATES and HOISTS

Metal or timber sluice gates of all sizes and designs, approved by engineers everywhere. Improved gate stands and hoists for hand or motor operation. Also flap and mud valves, shear and filler gates, trash racks and rakes. Dependable canal equipment from dam to tail-race since 1840.

Write for Special Catalog Today!

RODNEY HUNT

RODNEY HUNT MACHINE CO.

118 Lake St., Orange, Mass., U. S. A.

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

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GATE VALVE OPERATION

More and more cities and water departments throughout the land are turning to mechanical Gate Valve Operation performed by Dean gate valve operating trucks. From Abington, Mass., and Buffalo, N. Y., through Kansas City, Mo., to Wichita Falls, Tex., the Dean valve operator has been found to be of great value in the operation and maintenance of the water works systems, according to a recent bulletin issued by the Rensselaer Valve Co., Troy, N. Y. With pointed illustrations to show the reduction in man power and the increase in speed and safety of the Dean valve operator for opening and closing valves, this catalog presents pertinent points on operation and maintenance, the proper size of the operator, heavy duty models, the ease with which the operator can be changed from one truck to another, the application of the valve operator to a truck, as well as the reliability and low cost of mechanical valve operation. The catalog also shows the operating head and angle drive unit, chain drive and universal joints, and the revolution counter as well as junior models and the power take off.

This catalog on gate valve operation may be obtained from Rensselaer Valve Co., Troy, N. Y.

VERTICAL PUMPS AND DIESEL ENGINES

Two recent publications from the Worthington Pump & Machinery Corp. are **Vertical Turbine Pumps**

and **DD Diesel Engines.** The former, Bulletin H-450-B33 shows typical applications of the Worthington Vertical Turbine Pump for enclosed shaft and open shaft construction. Bulletin S-500-B38B on the Diesel engines covers such things as engine ratings, specifications for various parts of the engine, a complete diagrammatic drawing of the sections through the engine, water cooling system, pressure charged engines, and advantages thereof. Either or both of these bulletins may be obtained from the Worthington Pump & Machinery Corp., Harrison, N. J.

DIGESTER HEATER

Without doubt one of the most interesting developments in the sewage works field in the past year was the **P.F.T. Digester Heater and Heat Exchanger,** described in Bulletin No. 135 issued by the Pacific Flush-Tank Co., Chicago. This P.F.T. combined digester heater and heat exchanger has been developed to overcome the difficulties commonly encountered in the heating of sludge digestion tanks. Anyone who has ever operated a heated sludge digester tank is well aware of the disadvantages and problems encountered in the process.

With the P.F.T. digester heater and heat exchanger all raw sludge may be heated before entering the digestion system, thereby eliminating or reducing the variations in digestion tank temperatures. The unit itself, which is not unduly large for even a 1,000,000 Btu. per hour output, consists of an insulated rectangular steel tank filled with water through which tubes are carried for the circulation of material to be heated. Also contained in the same water bath are immersion type fire tubes in which the combustion of the gas or oil takes place. The fuel thus burned imparts the heat to the water bath and thus to the circulated material in the sludge tubes. The velocity at which the material to be heated is circulated is based upon considerations of economic pumpage cost, etc.

Catalog No. 135 discusses safety controls employed, gas or oil firing, temporary oil firing, building heating, operation of the unit, freedom from condensation and corrosion, piping arrangement, circulation rate, circulation pump capacity, capacity of standard units, and comparative costs.

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Designers of new digestion tanks and persons interested in improving the heating of digestion tanks already installed, should certainly write for Bulletin No. 135. Address the Pacific Flush-Tank Co., 4241 Ravenswood Ave., Chicago 13.

VERTICAL AND HORIZONTAL PUMPS

A four-page folder **Bull. No. B-136** has been issued by the Peerless Pump Div., of Food Machinery Corp., to show 60 types and styles of vertical and horizontal pumps manufactured by the Division. Types of pumps included in this Bull. B-136 are deep and shallow well pumps, Hi-Lift pumps, and domestic water systems, as well as horizontal and centrifugal pumps for diversified services. The horizontal pumps now manufactured by Peerless were formerly the Dayton-Dowd pump. All of the horizontal Dayton-Dowd-designed pumps now carry the Peerless name. Bull. B-136 may be obtained by writing the manufacturer, The Peerless Pump Div., of Food Machinery Corp., at 301 West Avenue 26, Los Angeles 31, Calif.

CONTROL OF SLIME FORMING ORGANISMS

Perhaps not too many water or sewage works are bothered with slime-forming organisms, and certainly a few of them will be interested in control of bacteria in a paper mill, and yet technical reprint No. RA-1057 of Wallace & Tiernan Co. contains two articles that do have some general interest along

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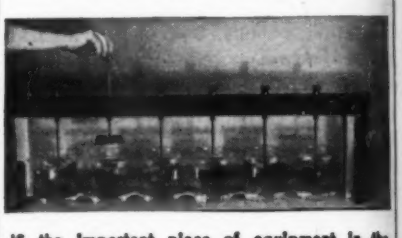
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these lines. The first of these articles is **Identification and Characteristics of Typical Slime-Forming Organisms** by R. B. Martin and John G. Dobson; the second gives **Experiences of a Paper Mill in Bacteriological Control** by Geo. M. Suydam and Ruth R. McConky.

In the first article a few of the more important types of organisms responsible for paper slime and other industrial difficulties are described and the laboratory procedures required for their identification are given. Methods of control are discussed and methods of procedure presented.

In the second article data are given to show the effects of various treatment employed by one paper mill for the production of paper of low bacterial count. Investigation shows that cleanliness throughout the mill, controlled break-point chlorination of the mill filtered water, and white water chlorination on the paper machine are all necessary for best results. This technical reprint RA-1057 may be obtained from Wallace & Tiernan Co. Inc., Newark 1, N. J.

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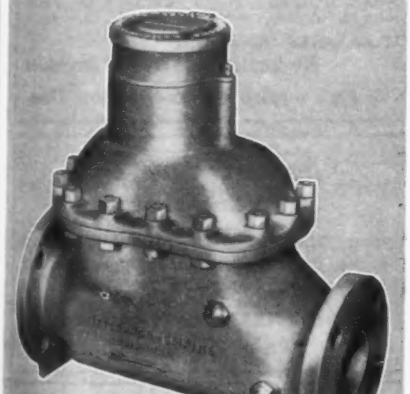

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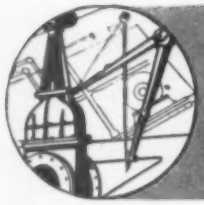

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B. On Settleable Solids

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At both plants, Digester Supernatant is returned to the Clarifiers.

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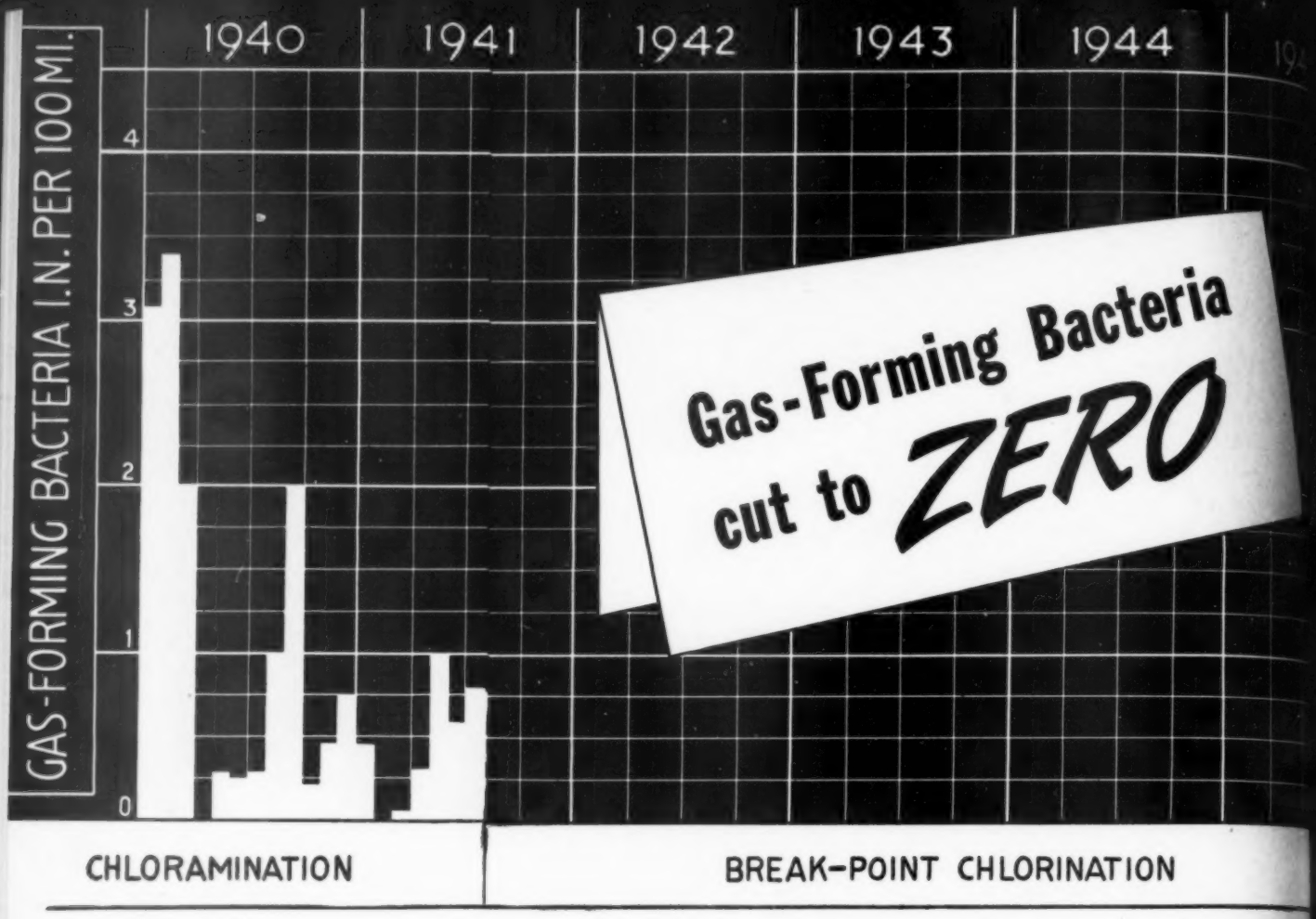

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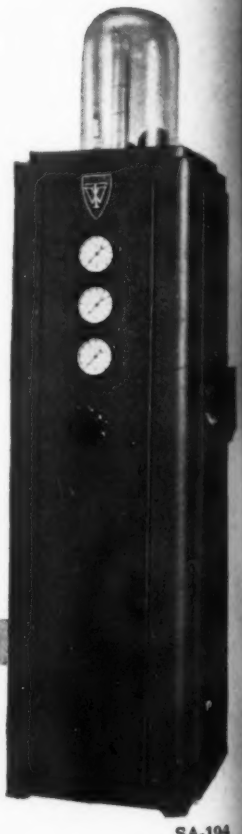
BACTERIOLOGICAL DATA

	CHLORA-MINATION	B-P CHLOR.	CHANGE
Tot. Bact. per ml (avg.)			
Raw	400.	458.	+14.5%
Applied	14.0	3.7	−73.5%
Filtered	2.6	0.6	−76.9%
Finished	2.2	0.4	−81.8%
I. N. (Indicated Number) Gas-forming Organisms per 100 ml			
Raw	1594.8	587.6	−63.1%
Applied	13.35	0.014	−99.8%
Filtered	1.69	0.022	−98.6%
Finished	0.94	0.000	−100.0%



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